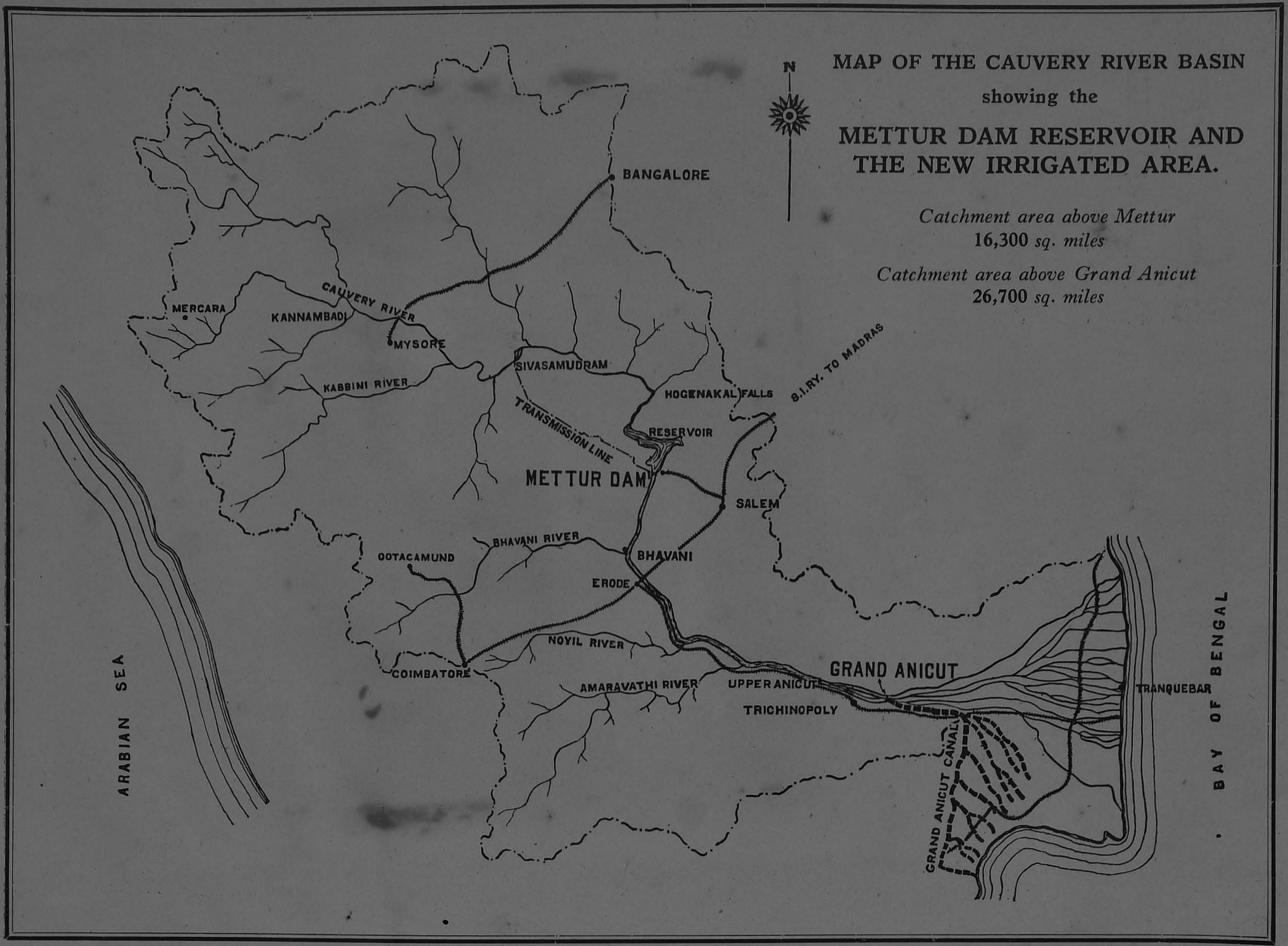
METTUR: ITS INDUSTRIAL POTENTIALITIES.

SECRETARIAT LIBRARY
8 DEC 1932
Regd
MADRAS GOVT.


MAP OF THE CAUVERY RIVER BASIN
showing the
METTUR DAM RESERVOIR AND THE NEW IRRIGATED AREA.
Catchment area above Mettur
16,300 sq. miles
Catchment area above Grand Anicut
26,700 sq. miles
N
BANGALORE
MERCARA
KANNAMBADI
CAUVERY RIVER
MYSORE
SIVASAMUDRAM
KABBINI RIVER
TRANSMISSION LINE
HOGENAKAL FALLS
S.I.RY. TO MADRAS
RESERVOIR
METTUR DAM
SALEM
BHAVANI RIVER
BHAVANI
OOTACAMUND
ERODE
NOYIL RIVER
COIMBATORE
AMARAVATHI RIVER
UPPER ANICUT
GRAND ANICUT
TRICHINOPOLY
TRANQUEBAR
GRAND ANICUT CANAL
ARABIAN SEA
BAY OF BENGAL

METTUR

AND ITS

INDUSTRIAL POTENTIALITIES

SECRETARIAT LI
8 DEC 1932
MADRAS GOV

By L. B. GREEN, M.B.E., Deputy Director
of Industries, Government of Madras

PRINTED AT THE GOVERNMENT PRESS, MADRAS

1932

X8·2116·M
N32

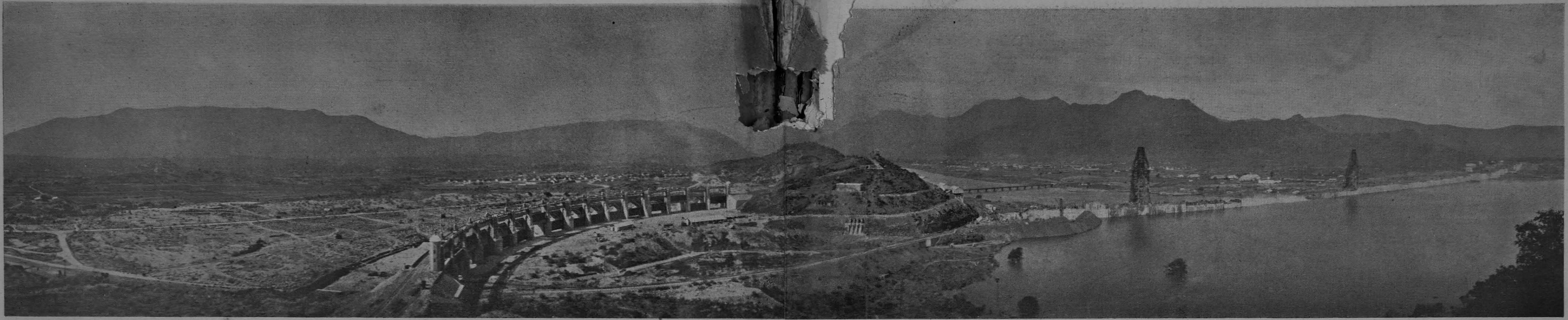
TAMILNADU ARCHIVES LIBRARY
No. 15726
EGMORE, MADRAS-600 008

CONTENTS

	PAGE
Introduction	6
Brief History of the Mettur Project	8
Geographical Situation and Communications	13
The Existing Buildings of the Settlement	15
Climatic Conditions	22
Availability and Cost of Labour	23
Water-supply	24
Supply and Cost of Power	25
Resources of Surrounding Areas	27
Irrigation by Electric Pumping	28
Availability of Sites and Land for Industrial Mills and Factories	30
Scope for the Establishment of Industries—	
(*a*) Cottage Industries	31
(*b*) Textile Mills	32
(*c*) Oil Seed Crushing and Manufacture of Vegetable Fats	36
(*d*) General Chemical Industries	39
(*e*) Pulp and Paper Industry	43
The Iron Ores of Salem	47
Salem Magnesite	49
Appendices	51

Maps and Illustrations

Map of the Cauvery River Basin	*Frontispiece*
Panoramic View of Mettur and Dam Headworks	6-7
Map of the Cauvery-Mettur Project Headworks	10-11
Map showing Road and Railway Communications	12
Buildings of the Settlement	14, 16, 18, 19, 20, 21, 23
General Hospital	22
Power Station	26
General View of Salem Camp	29



Panoramic View of Mettur and Dam Headworks.

INTRODUCTION.

THE Mettur Project, it is expected, will be completed in 1934 and the headworks area with its buildings will then be available for disposal. The headworks area includes Mettur township on the right bank of the river Cauvery, in the Mettur taluk of the Salem district, with an extension on the left bank. The two parts are connected by a girder bridge of sixteen spans across the Cauvery, carrying two lines of tramrail and a road. The site is connected with Salem Junction on the main line of the South Indian Railway (broad gauge) by a branch line 26 miles long, and with Erode, another junction on the main line, by a first class motor road 35 miles long. This branch line also forms part of a projected railway from Trichinopoly via Namakkal-Salem-Dharmapuri-Hosur to Bangalore. When this through communication is established, it will tap the Bangalore area and be the shortest route for bringing cotton, etc., from Bellary to Mettur. The township, as will be seen from a perusal of this pamphlet, possesses the most up-to-date amenities; it is carefully laid out, and traversed by metalled roads, and will shortly be connected by a metalled road with the Madras-Calicut trunk road. When this new road to Thoppur is completed, as it is expected to be before the completion of the project, the road through Mettur will be the shortest bridged route from Madras to Calicut and the Nilgiris.

The potentialities of Mettur as an industrial centre are very considerable, for not only will the area have all the weighty advantages of cheap power, ample supply of water, proximity to cotton and groundnut tracts, reasonably good communications and climatic conditions, housing accommodation for a large industrial population and an organized and contented labour force, but in addition, Mettur has a plenitude of excellent factory sites in proximity to the railway and the river Cauvery, whilst the red and gravel subsoil of the area is very suitable for building construction.

The object of this pamphlet is to invite the attention of manufacturers in India and abroad to the facilities which will be afforded by Mettur, on the completion of the Project in 1934, as a suitable location for the establishment of manufacturing industries and the setting up of mills and factories of various kinds. An endeavour has been made to supply such information as may be of interest to manufacturers who may be considering establishing factories in the Madras Presidency.

The Director of Industries, Post Box 432, Chepauk, Madras, will be pleased to answer enquiries from manufacturers, or prospective manufacturers, who are interested in the possibility of establishing mills or factories in the Mettur area. Plans of the site and of the existing buildings may also be obtained on request.

BRIEF HISTORY OF THE METTUR PROJECT.

THE Cauvery rises near Mercara in Coorg and drains a considerable area of the Western Ghats where there is heavy rainfall during the south-west monsoon, i.e., from June to August. This monsoon provides the greater part of the water carried by the river and occasions the high floods. The river flows generally in a south-easterly direction and after a course of several hundred miles, eventually falls into the Bay of Bengal through a series of insignificant mouths. The area drained by the river in its course up to the head of the delta is over 26,000 square miles in extent, an area approximately equal in size to Ireland (excluding Ulster). The main river is joined below the Kannambadi Dam in Mysore by several important tributaries, and these tributaries, except the Bhavani, which benefits from both monsoons, are mainly fed by the north-east monsoon, i.e., from middle of October to December, and hence help to maintain the water level in the main stream when flow tends to diminish owing to the dying away of the south-west monsoon. The head of the Cauvery delta is ten miles west of Trichinopoly and here the river bifurcates into two large branches. The northern branch is known as the Coleroon, while the southern branch retains the name Cauvery. The southern branch is utilized as the main channel for the supply of irrigation water to the delta. It divides and subdivides into innumerable branches which form a network of tributaries all over the delta. The branch which retains the name Cauvery enters the sea as an insignificant stream at a point eight miles north of Tranquebar.

Irrigation in the Cauvery delta has been practised from very ancient times, though it was then more an inundation system than a controlled irrigation system. When the East India Company took over Tanjore district in 1801, however, irrigation in the delta was rapidly deteriorating, channels were silting up and lands were left uncultivated for want of water. Great efforts were made by District Officers to remedy this state of affairs, but it was not until 1836, when the Upper Anicut was built upstream of the point where the Coleroon and Cauvery bifurcate, that difficulties of water-supply were overcome. This proved so effective that a dam had to be built across the Cauvery to curtail the supply and prevent damage by erosion. Further improvements have been carried out since, the most important of which was the construction of the Regulator at the Grand Anicut in 1887–89. The results soon became manifest, for land rose in value, the assessment of the lands was raised, and the general condition of the country and the people improved. It was realized, however, that supply to the delta was capable of yet greater improvement and that further improvement depended on storage. A dam across the Cauvery at a suitable site to store up the excess water available during the monsoon and pass it down later when required for irrigation was the obvious solution. This dam is at present under construction at Mettur. The decision to build a dam at Mettur was not reached without mature consideration and the protracted

discussion as to the relative merits of a dam across the Cauvery and the Bhavani which started some 60 years ago was settled only in 1910 when Government accepted Colonel Ellis's proposal to build a dam at Mettur. Colonel Ellis's project was held up by the War and by long drawn out discussions and arbitration between the Madras Government and the Mysore State as to their relative water rights, and it was not until 1925–26, after 10 years daily river gaugings had been carried out, that an agreement was reached satisfactory to both parties and a start made. The first blast was made in the presence of His Excellency the Governor on 20th July 1925 and with a slight modification the scheme drawn up by Colonel Ellis was actually initiated.

The project now under execution provides for the following :—

(i) Constructing a dam across the Cauvery at Mettur to form a reservoir of an effective capacity of 93,500 million cubic feet or 2·15 million acre feet. The area of the lake to be formed will be 59·25 square miles.

(ii) Constructing a canal and distribution system taking off from the right of the Cauvery just above the Grand Anicut to supply Cauvery water to a new area of 301,000 acres of rice crop, 84,000 acres of which will grow two crops.

(iii) Improving by means of the reservoir, the water distribution and supply to the existing wet area in the Cauvery Delta (roughly 1,000,000 acres) and for extending in this area the extent of double cropped lands by 70,000 acres.

(iv) Providing continuously all the year round not less than 15,000-h.p. by turbines supplied with water from the Mettur lake.

(v) Regulating high flood discharges of Cauvery (e.g. the flood of 1924) to an extent which will materially reduce the damage to the country lower down the river.

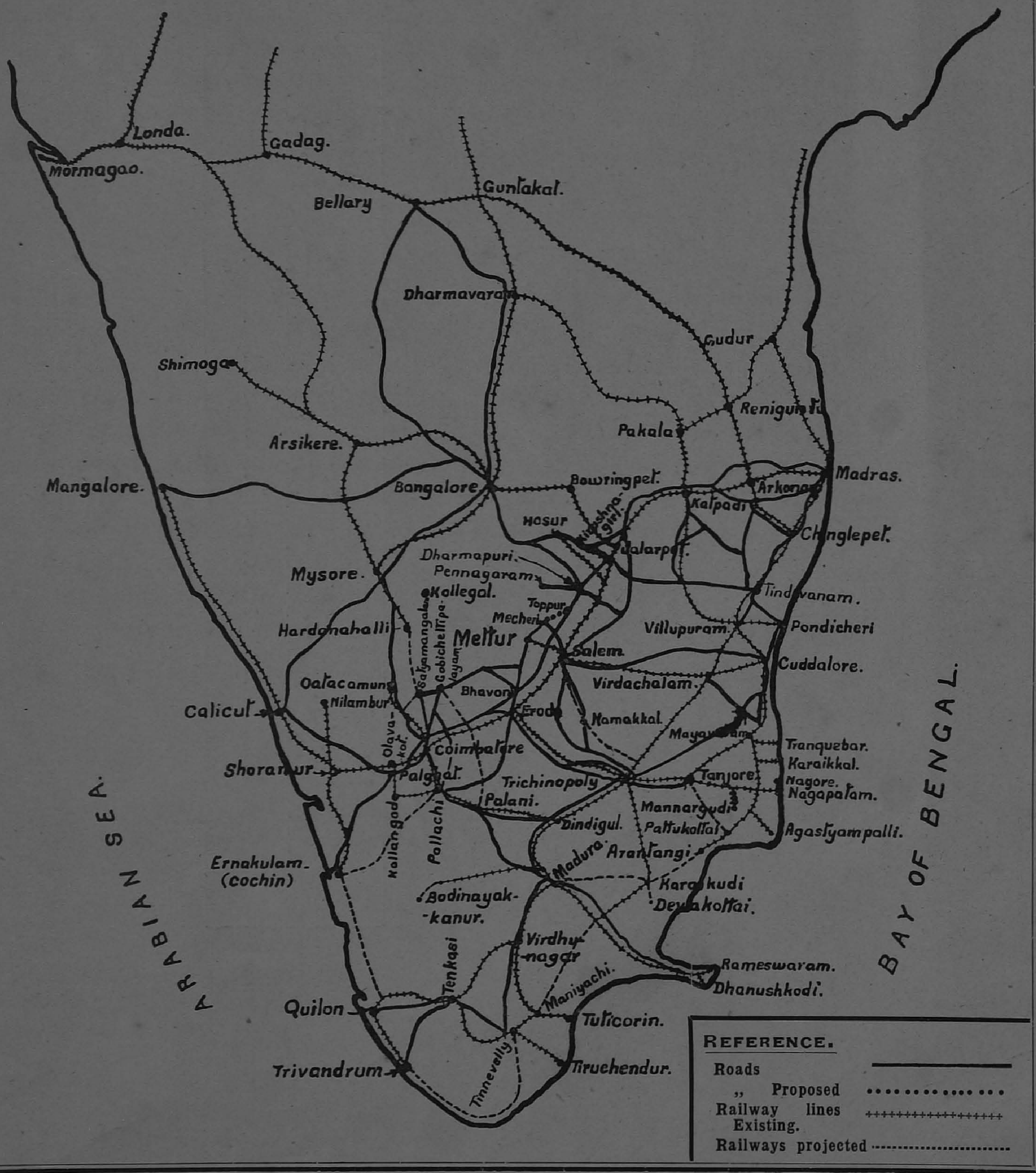
The estimated cost of the project is about seven crores of rupees (over 5 million sterling) and the anticipated revenue will give a net return on the capital invested of not less than 6 per cent. The actual dividend on the capital invested, however, does not take into account the indirect benefits which must accrue from the development and improvement of irrigation in the tract of country that the project will serve. Greater prosperity of the people, better roads, more schools, increased revenue from posts and telegraphs and industrial development in various forms must inevitably follow.

CONTOUR MAP OF THE
CAUVERY-METTUR PROJECT HEAD WORKS
Showing part of the area of the new lake.
SCALE
1 Mile
AREA OF
PART OF NEW LAKE
RIVER
CAUVERY
SURPLUS
Ellis Saddle Camp
Sewage Farm
Sinnakkavur
Thollipalli
Karumankudal
Left Bank Quarries
Dam Line
Kullavirampalli
Smith's Knoll
Combined Office
Recreation Club
Foremen
Mechanics
Power House
Cement Shed
Thukkanampalli
Church
Officers' Quarters
Dairy Farm
Sunday Fair
To Sand Depot
Right bank Quarries
Sonangalpudur
F Saddle
Maasilapalayam
Sewage Farm

MAP OF SOUTH INDIA

Showing Road and Railway Communications to Mettur Dam Station.

Scale 1″ = 100 Miles.



GEOGRAPHICAL SITUATION OF THE METTUR SETTLEMENT AND COMMUNICATIONS—ROAD AND RAIL.

PRIOR to the initiation of work on the Project, Mettur was a small hamlet situated on the banks of the Cauvery 35 miles north of the nearest convenient railway station—Erode—on the South Indian Railway, and communication between Erode and Mettur was for the greater part of the way along an unmetalled village track practically impassable in the rains. The first problem therefore which the Engineers had to solve was to convert the hamlet of Mettur into a healthy town of a size sufficient to accommodate the population necessary to build the dam in the scheduled time, and to connect this town with the railway by a first-class metalled road over which to transport the thousands of tons of materials required, first to build the town and then the dam.

Mettur settlement or township, which is situated on the banks of the Cauvery on the border line between Salem and Coimbatore districts, covers an area of $1\frac{1}{2}$ square miles. It consists of two parts, the eastern and the western, the Cauvery running between them. The eastern portion is known as Salem Camp and the western as Mettur Camp and the two camps are connected by a first-class bridge across the Cauvery about 1,200 feet long. The nearest railway station is the Mettur Dam railway station, connected to Salem Junction, distant 26 miles, on the South Indian Railway main line, by a broad gauge line. There is also, as previously mentioned, an excellent road from Erode to Mettur, a distance of 35 miles. This road, which is at present the sole communication to the rest of the Coimbatore district will become part of the main road from Madras to Calicut on the West Coast when the proposed Mettur-Mecheri-Thoppur road is completed.

A map showing road and railway communication will be found on the opposite side.

General Offices (Southern wing).

THE EXISTING BUILDINGS OF THE SETTLEMENT.

CLIMATIC conditions and circumstances have necessitated an expenditure on housing greater than would be required for a work of similar magnitude in Europe or America. In the latter continents provision would be made only for actual workers but in Mettur the families and dependents of the actual workers have to be provided for. A few of the buildings in the Salem Camp such as Supervisors' and Subdivisional Officers' quarters, the Travellers' Bungalow and the quarters of the subordinate Public Works Department staff are permanent buildings intended to remain in charge of the Public Works Department after the completion of the Project, while the Mettur Camp which includes Mettur village will no longer be required by the Public Works Department and will be available for industrial firms who may decide to set up factories and mills there. It forms the main portion of the Mettur Settlement and is 2 miles 5 furlongs from north to south and 5 furlongs from east to west. The Mettur Camp contains the following buildings which will not be required after the completion of the headworks :—

1. The Administrative Offices.—This building which occupies an extent of about one acre and is situated almost in the centre of the Mettur Settlement is a quadrangular construction enclosed on three sides with an open space in front. The southern portion is provided with an upper storey while the northern portion is a single roofed construction. The building consists essentially of a number of large halls partitioned by walls 9 inches thick, for the use of officers. The building is chiefly stone-in-mud for the first floor and brick-in-clay for the second with brick-in-mortar and stone-in-mortar all around the doors and windows. The woodwork consists of pillamarudu procured from Malabar. The rafters are all of this timber supported by steel girders. The doors and windows are of pillamarudu. All the buildings in the Settlement are of this type. There are well laid out and metalled roads to the east, west and south of this building. In the vicinity of the office are found the quarters devoted to the subordinate staff both ministerial and executive. There are separate quarters for clerks of the junior grade and senior grade ; and similarly separate quarters for supervisors and subdivisional officers of junior and senior grades. The quarters are constructed in rectangular plots with well laid out roads and are provided with electric lights and service water-taps. The coolie lines which come next are also built with reference to the requirements of the labourers employed on the project. The better-paid artisans and skilled labourers have slightly superior accommodation and broader space while the lower-paid labourers have quarters of smaller capacity. For the labourers' lines there is no house service, but taps are provided at convenient points for the use of the occupants. The southern outskirts of the Settlement are devoted to the officers' quarters. There are quarters constructed suitable for one

Superintending Engineer's Quarters.

Indian Engineer's Quarters.

Engineer-in-Chief, one Superintending Engineer, six European Executive Engineers and two Indian Executive Engineers, with well laid out compounds attached.

The roads and streets are lighted with electricity and the Settlement is supplied with highly filtered and chlorinated water from the river Cauvery. Accommodation is provided for a population of 5,000 in the Salem Camp and 10,000 in the Mettur Camp. Within the headworks area, there are 1,800 permanent coolie huts and about 1,250 more of the temporary type.

2. A well-equipped Hospital on raised ground on the right bank of the Settlement occupies about 10 acres. Adjacent to the hospital there is the Settlement Health Officer's office. This officer is provided with quarters of the type provided for subdivisional officers.

3. A Power-House with corrugated iron roofing.—In it the electricity obtained from Sivasamudram, a distance of 62 miles from the power-house, is transformed and utilized for electric lighting and power purposes.

4. Workshop with corrugated iron roofing maintained for the purpose of repairing machinery and implements used in the project works. Only a portion of the machinery employed in the workshops will be required on the completion of the project and most of it will be available for disposal to manufacturers who set up plants at Mettur.

5. Ice Factory.

6. Water-works.—This has been described in the paragraph devoted to water-supply, on page 24.

7. Two Rest-Houses, one for Indians and another for Europeans.

8 (a) Two Churches, one for Catholics and another for Protestants.

(b) Two Temples for Hindus, one of Anjaneya and the other for Ganesh as well as a small Mosque for Mussalmans.

9. An old parish church has been converted into a Co-operative Stores from which the staff obtains its supplies.

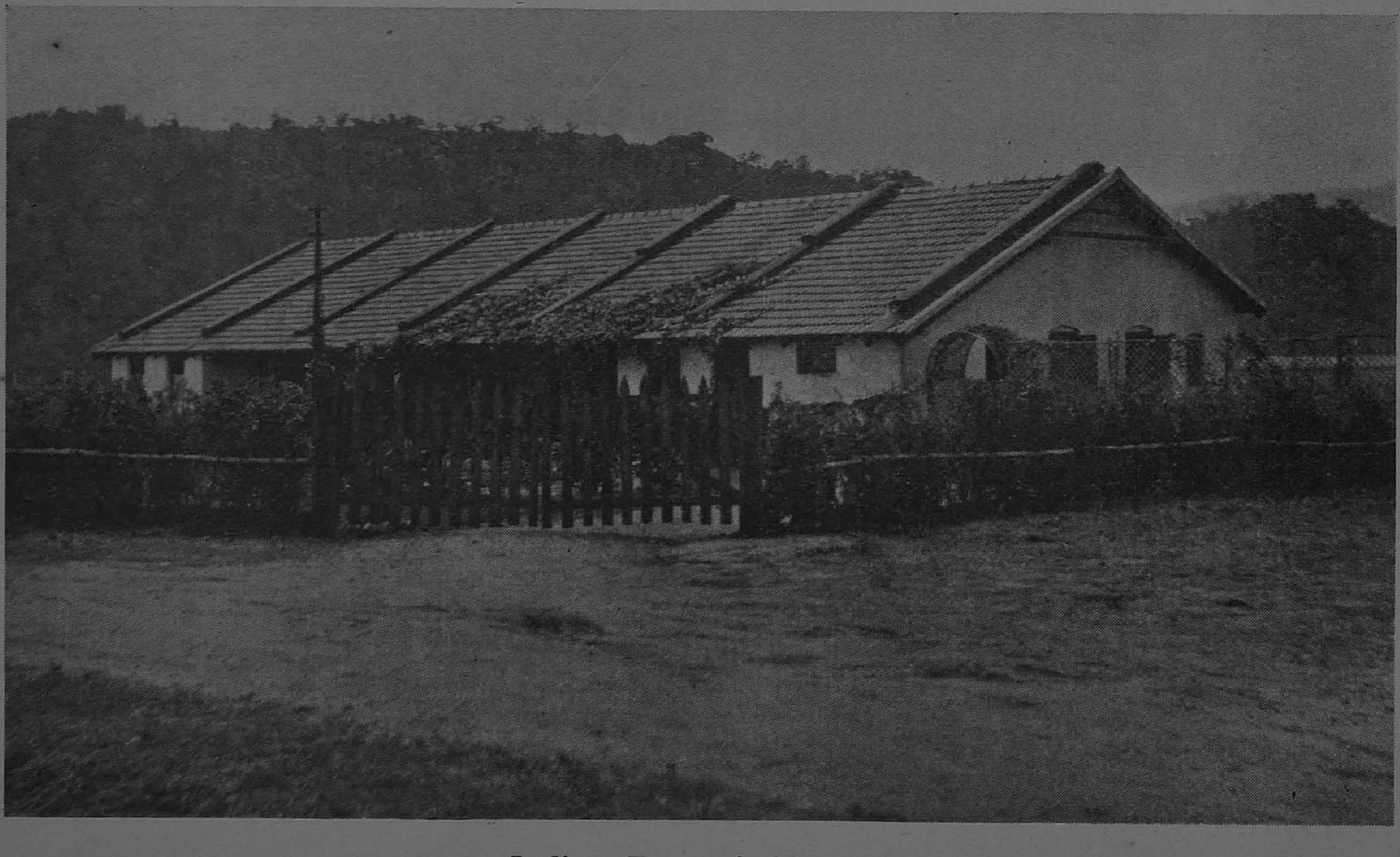
10. A Theosophical Lodge and Reading Room with a compound of its own.

11. A Reading Room for non-gazetted officers with two tennis courts attached to it.

12. A Public Market and a few shops for the sale of provisions and other articles of consumption.

One of the sights of Mettur is the Sunday shandy or market. A special area south of the camp has been walled in, and in the enclosure so formed stalls have been built. Each Sunday thousands flock to the shandy not only from Mettur, but from all surrounding villages. Mettur shandy is now one of the largest in the neighbourhood.

Supervisors' Quarters.

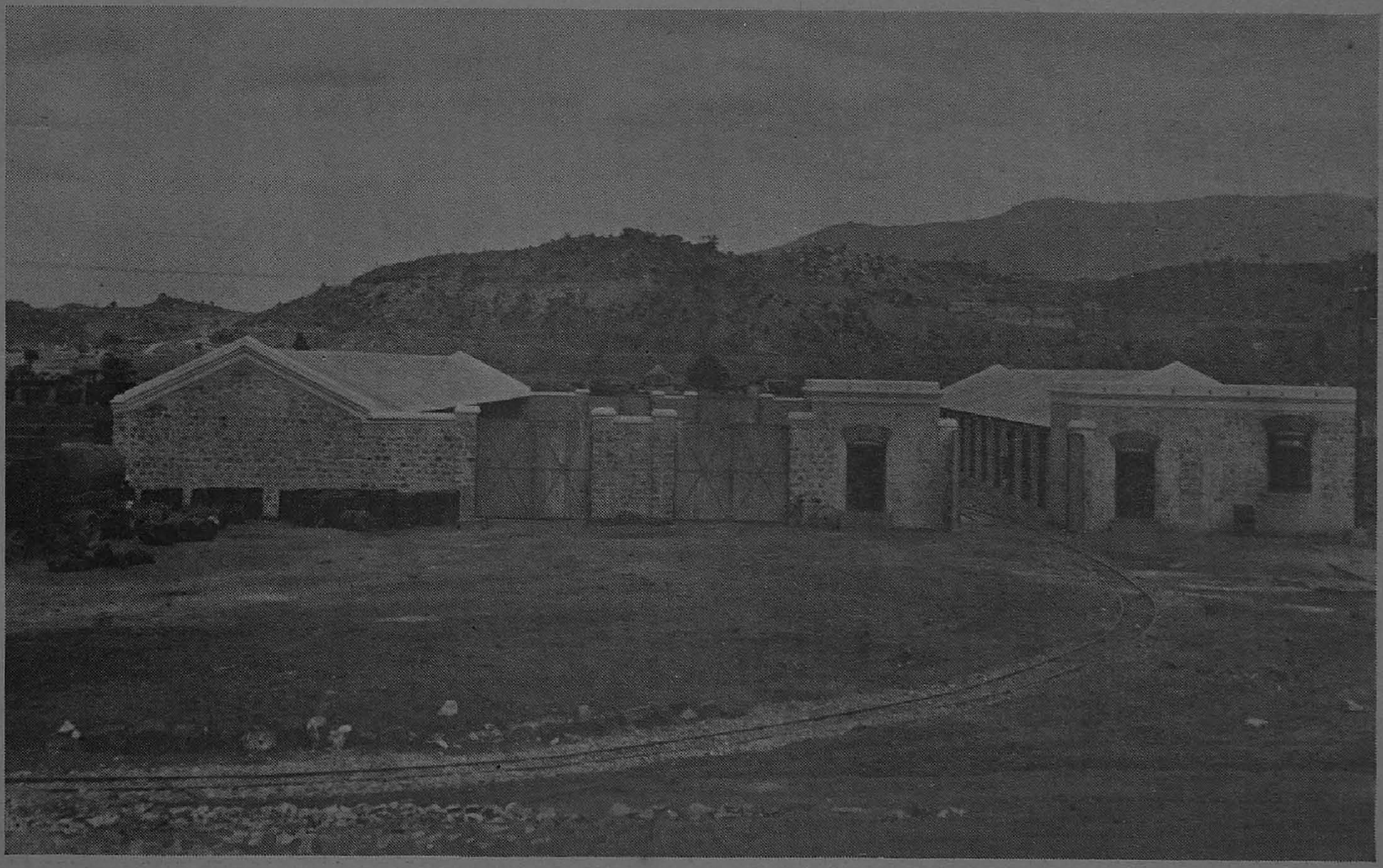


Indian Erectors' Quarters.

13. In addition to the quarters provided by Government, there are extensive coolie lines of a temporary character provided by the contractors for their own labourers in both Salem and Mettur Camps.

In the Salem Camp there are fewer buildings ; quarters for workmen, supervisors and subdivisional officers have been provided. There is also a Dispensary, an outpost Police Station and a Rest House. There is a large corrugated iron roofed building near Mettur Dam Railway Station which is used at present as a cement store. The railway wagons run directly into the store which is admirably arranged for the receipt and despatch of goods. The number and nature of the buildings and quarters referred to in this chapter will be found detailed in Appendix A, on page 51.

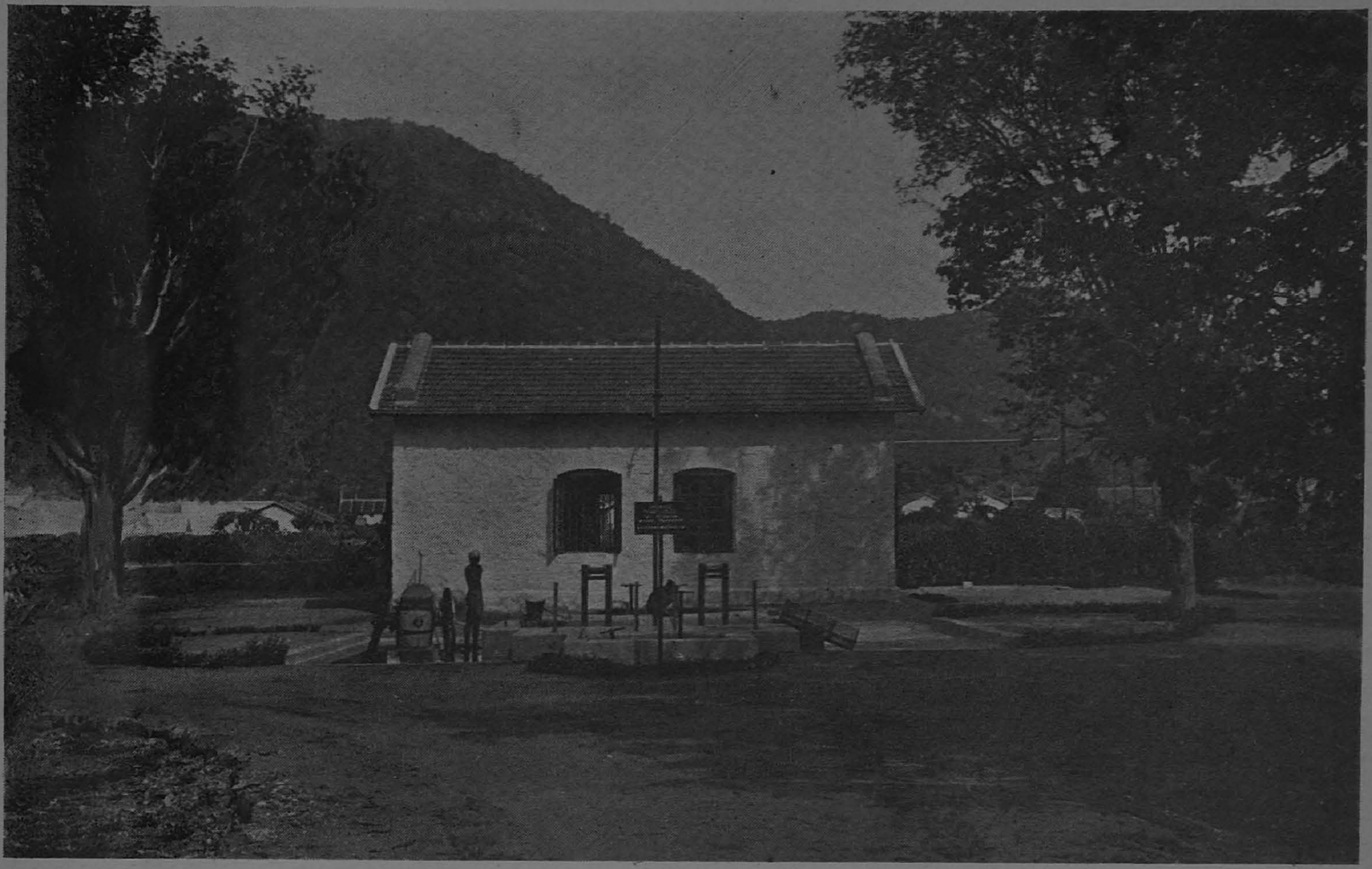
It will be seen from the foregoing that Mettur is unusually well provided with housing accommodation for a very large industrial population, and with all the amenities requisite, but not always found, in a modern industrial township for the conversion into which the Settlement offers great scope and unrivalled advantages.

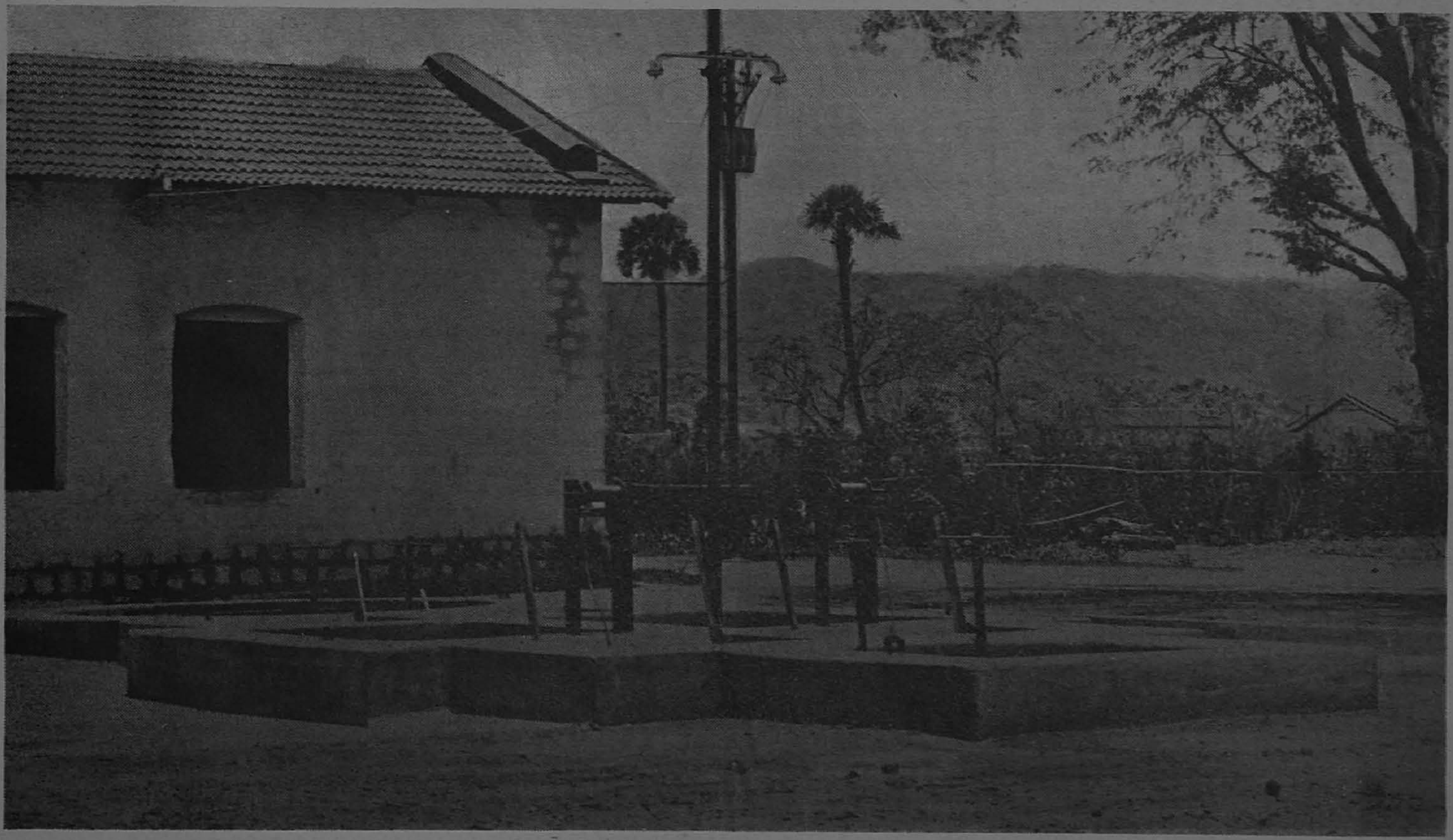


General Stores.

Higher Grade Mechanics' Quarters.

Lower Grade Mechanics' Quarters.

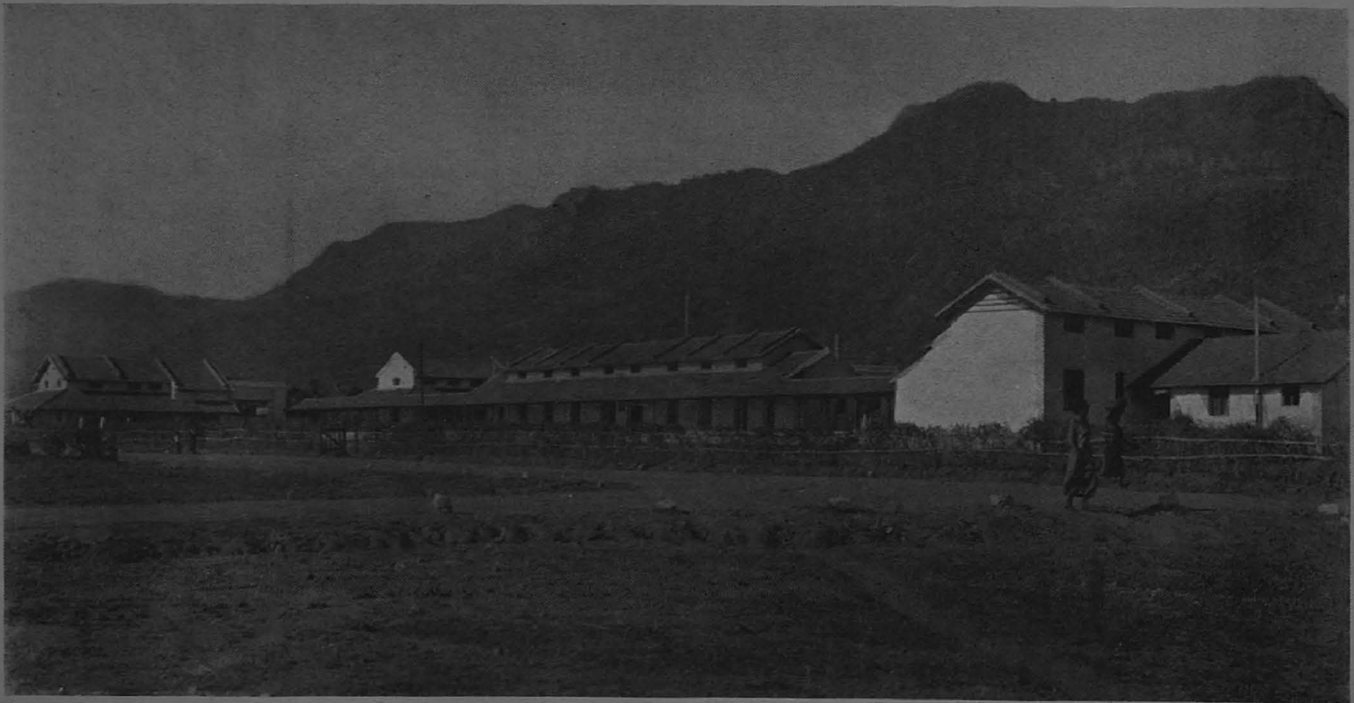




5 *Sewage Pumping Station.* 21

CLIMATIC CONDITIONS.

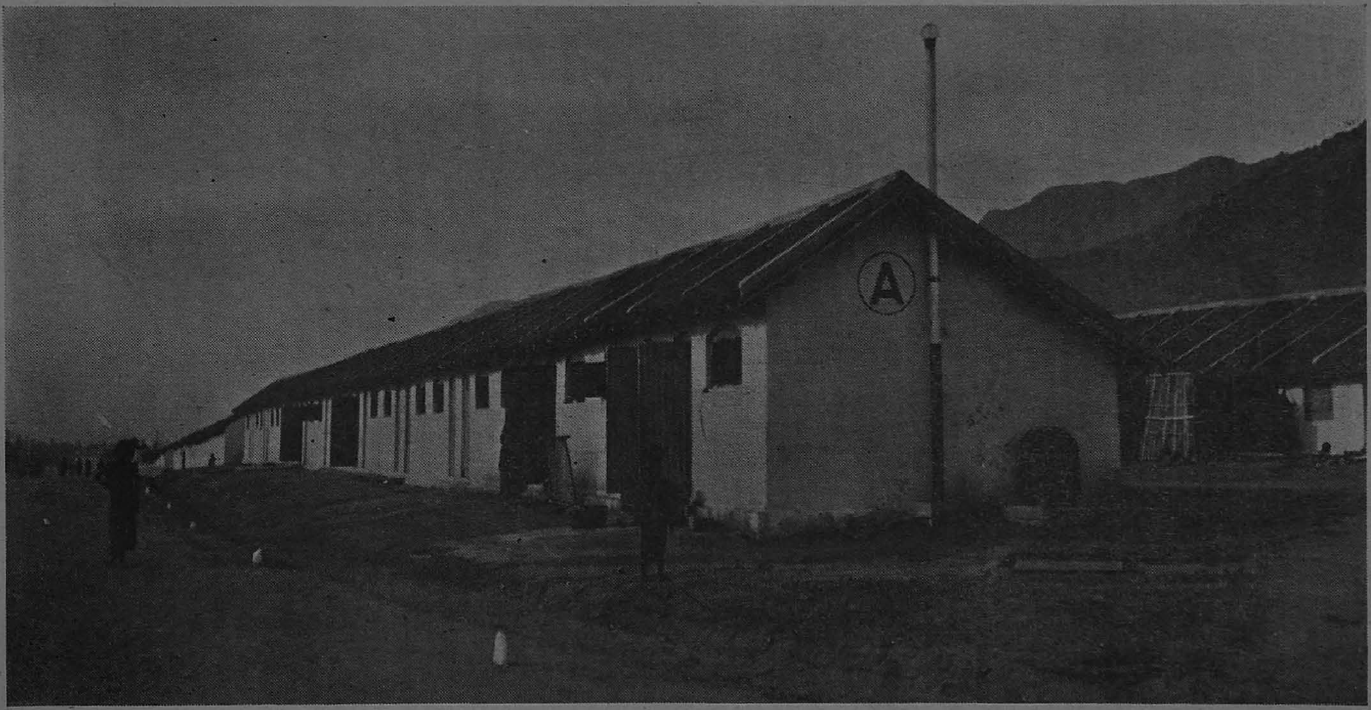
THE Mettur Project area is, as already stated, divided into two camps—the Salem Camp and the Mettur Camp—both of which are situated in valleys between high ranges of hills. The former is about 800 feet and the latter 660 feet above sea level. The temperature varies from a minimum of 60° F to a maximum of 110° F. The nights are as a rule very cool compared with the day and there is a large difference between the maximum and minimum temperature during the day. May is generally the hottest month and December the coldest. Heavy and sudden gales are a feature of Mettur during the hot months. During the two storms which occurred in May 1927 and May 1928, the velocity of wind was probably 50 miles per hour and heavier gusts may be expected. These storms are sometimes even cyclonic and are occasionally accompanied with a heavy downpour of rain. In Appendix B will be found an extract, for the period from February 1928 to April 1932, from the weather reports of the rainfall and evaporation station at Mettur. It is necessary to point out however that the total rainfall of 54 inches in 1929 is considerably more than that of an average year and that about 35 to 40 inches may be taken as the average. The maximum intensity may be taken as about 8 inches per day and about 4 inches in one hour. In considering the suitability of Mettur for the establishment of different industries, it is necessary to take into consideration the possible effects of the large waterspread which will be formed after the construction of the dam, as this may be expected to render the climate more humid, thus facilitating the establishment of industrial factories such as cotton spinning and weaving mills.



General Hospital.

AVAILABILITY AND COST OF LABOUR.

THERE has been no special difficulty experienced in procuring labour for the Mettur Project, and this is no doubt attributable to the attractiveness of the accommodation and the excellent sanitary conditions in the coolie lines. Government decided that the scale of accommodation for labour should be high and Mettur is now the most up-to-date industrial centre in the Madras Presidency. An ample supply of pure filtered and chlorinated water, elsewhere referred to, is always available. An underground drainage system serves the greater part of the Mettur Camp and flush latrines have been provided for coolies, peons and menials. In order to look after the health of the camp, a large health staff is employed under a qualified Health Officer. A hospital with 36 beds is attended to by a medical officer who belongs to the Madras Medical Service, and working under him are two sub-assistant surgeons, one on the Mettur side at the main hospital, the other in charge of the dispensary at Salem Camp. The hospital is popular and well attended, the majority of the inmates and out-patients are dependents of workers and in this case also the social habits of the people have necessitated an expenditure on medical relief out of proportion to the actual workers. The same remarks apply to the water-works and drainage systems which had to be designed to accommodate a far greater population than are actually engaged on the project works. In short, it may be said that everything that can reasonably be expected has been done by Government to provide accommodation and amenities in advance of those usually considered necessary. The result is that labour is satisfied, easily recruited and easily kept. The present labour population at the headworks amounts to about



Coolie Lines.

11,800, of which 8,700 reside in the Salem and Mettur Camps and the rest in adjoining villages. Within the headworks area, there are 1,800 permanent coolie huts and about 1,250 more of the temporary type.

Wages at the headworks for skilled and unskilled labour are as follows :—

Man-coolie—7 annas to 8 annas a day.
Woman-coolie—4 annas a day.
Boy—4 annas a day.
Wodders—10 annas to 14 annas a day.
Bricklayers—Rs. 1-4-0 to Rs. 1-8-0 a day.
Stone-cutters—Rs. 1-4-0 to Rs. 1-8-0 a day.
Carpenters—Rs. 1-4-0 to Rs. 1-8-0 a day.
Artisans—Re. 1 to Rs. 1-8-0 a day.

It will thus be seen that Mettur, on the completion of the project, will be able to offer the most up-to-date amenities of a modern industrial township such as are required to attract and retain a contented labour force. If new industries are started sufficiently early, the labour force employed on the project works may be gradually absorbed.

WATER-SUPPLY.

METTUR is in a very favourable position as regards water-supply. The Water-works constructed in connexion with the project consist of two reservoirs, a high level reservoir and a low level reservoir designed to supply water both to the Works and the Settlement. The high level reservoir is intended for the supply of water to the Salem Camp and to the higher regions of the dam in the Mettur Camp while the low level reservoir provides for the requirements of the Mettur Camp. The capacity of the high level reservoir is 200,000 gallons, while that of the low level reservoir is 400,000 gallons of purified chlorinated water. The capacity of the filtering plant, which is at present worked for 16 hours, is 1,000,000 gallons per day. In Appendix C on page 54 will be found the results of chemical examination and analyses of the water by the King Institute, Guindy.

Water for industrial purposes could be obtained in almost any quantity from the river Cauvery, both on the Mettur and Salem sides, although the amount diverted to irrigation is limited by an agreement with the Mysore Government. On the Salem side of the river, an escape is under construction for the discharge of surplus water during high floods. The surplus flow will follow a well-defined course and find its way back into the river on the rear side of the dam. Factories situated on the Salem side would be able to draw the water they require for industrial purposes from this surplus flow during the three to four months in the year that it is available and by pumping from the river at other times.

SUPPLY AND COST OF POWER.

THE electric power required for the Project Works is at present obtained from Sivasamudram and the anticipated load when work gets into full swing will be over 6,000 K.W. According to the agreement with the Mysore Government, the supply will be available until the completion of the dam and the cost has been fixed on a sliding scale of charges ranging from 0·55 anna to 0·75 anna per unit depending upon consumption.

When the dam is completed, electric power will be generated on the spot from the head of water in the reservoir and a minimum of 15,000-h.p. will be available continuously. Four power pipes 8′ 6″ bore are now being built in the dam for this purpose and will eventually lead the water to the turbines in the future Power House on the downstream side of the dam.

The proposal is to link Mettur with the Pykara Scheme designing the Mettur plant for the base-load with Pykara taking up the peaks of the loads. The plant will consist of four turbines, one of which will be a spare, each having a capacity of 5,300-h.p. at 60 feet head and 14,600-h.p. at 160 feet head. At an average head of 125 feet and discharge 2,750 cusecs, the power developed would be 33,000-h.p. while 49,000-h.p. could be generated in an emergency. Of the power generated only about 200-h.p. will be required for operating the sluices, for water works and drainage and for electric lighting if the camp is retained after construction. The rest of the power will be available for supply to industrial concerns that may establish themselves in the area, and the rates given in the tariff below will, in general, apply :—

High Tension Tariff at 11 K.V. or 22 K.V.

I. General purposes—

Classes.	Total monthly consumption in K.W.H.	Rate per K.W.H. Anna.		Rate per K.W. of maximum demand per month.
I. Up to	45,000	... 0.60	plus	
II. Exceeding	45,000 and up to 80,000	... 0.55	plus	Up to 500 K.W. Rs. 4.
III. ,,	80,000 ,, 140,000	... 0.50	plus	Over ,, Rs. 3-8-0.
IV. ,,	140,000 ,, 200,000	... 0.45	plus	,, 1,000 K.W. Rs. 3-4-0.
V. ,,	200,000	... 0·40	plus	

At the option of the consumer the demand may be billed on a K.V.A. basis in which case the above rates will be reduced by 4 annas per month per K.V.A.

The demand payment will be a fixed monthly charge, whether energy is consumed or not and constitute a minimum monthly payment. It will be based on the highest of the average of the monthly maximum demands for the previous twelve months.

The above tariff is subject to a maximum overall unit charge of 1·00 anna per unit without prejudice to the minimum monthly payment.

II. Large textile mills and industrial establishments.—The maximum demand charge for textile mills and factories where power is primarily used for industrial purposes guaranteeing an annual consumption of not less than 400,000 units will be Rs. 3–4–0 per K.W. per month or alternatively Rs. 3 per K.V.A. per month plus an energy charge of 0·45 anna per unit up to 200,000 units per month and 0·40 anna per unit when the consumption exceeds 200,000 units per month.

This tariff is subject to an overall unit charge of 0·75 anna per unit without prejudice to the minimum monthly payment.

III. Heat for steam-boilers.—High tension power for electric steam-boilers used in conjunction with steam-accumulators for process work, if connected to an independent power circuit and used only between the hours of 10 p.m. and 7 a.m. will be allowed a 50 per cent rebate (on the rates outlined in paragraph 1).

IV. Seasonal power.—All bills for power for the months of July, August and September in excess of the average bill for the previous nine months, i.e., the period 1st October to 30th June, will receive a rebate of 20 per cent on the amount of such excess. Any month in the above period in which no power was consumed or minimum charge paid will not be included for the purpose of calculating the average bill.

Power Station.

V. Special rates.—Rates for railway electrification, licensees, isolated installations or special loads will be arranged by negotiation.

VI. Power factor.—High tension or low tension tariffs, not based on a K.V.A. rate, will be liable to a surcharge of 8 annas per K.W. of maximum demand per month when the resultant power factor of the load is less than 0·80 for any month. Should the resultant power factor fall below 0·70 on the above basis, then the power service may be discontinued until the power factor has been corrected to 0·80 or above.

RESOURCES OF SURROUNDING AREAS.

THE chief industrial crops in the area surrounding Mettur are groundnut and cotton and the area under these in the Salem and Coimbatore districts in the year 1930–31 was as under :—

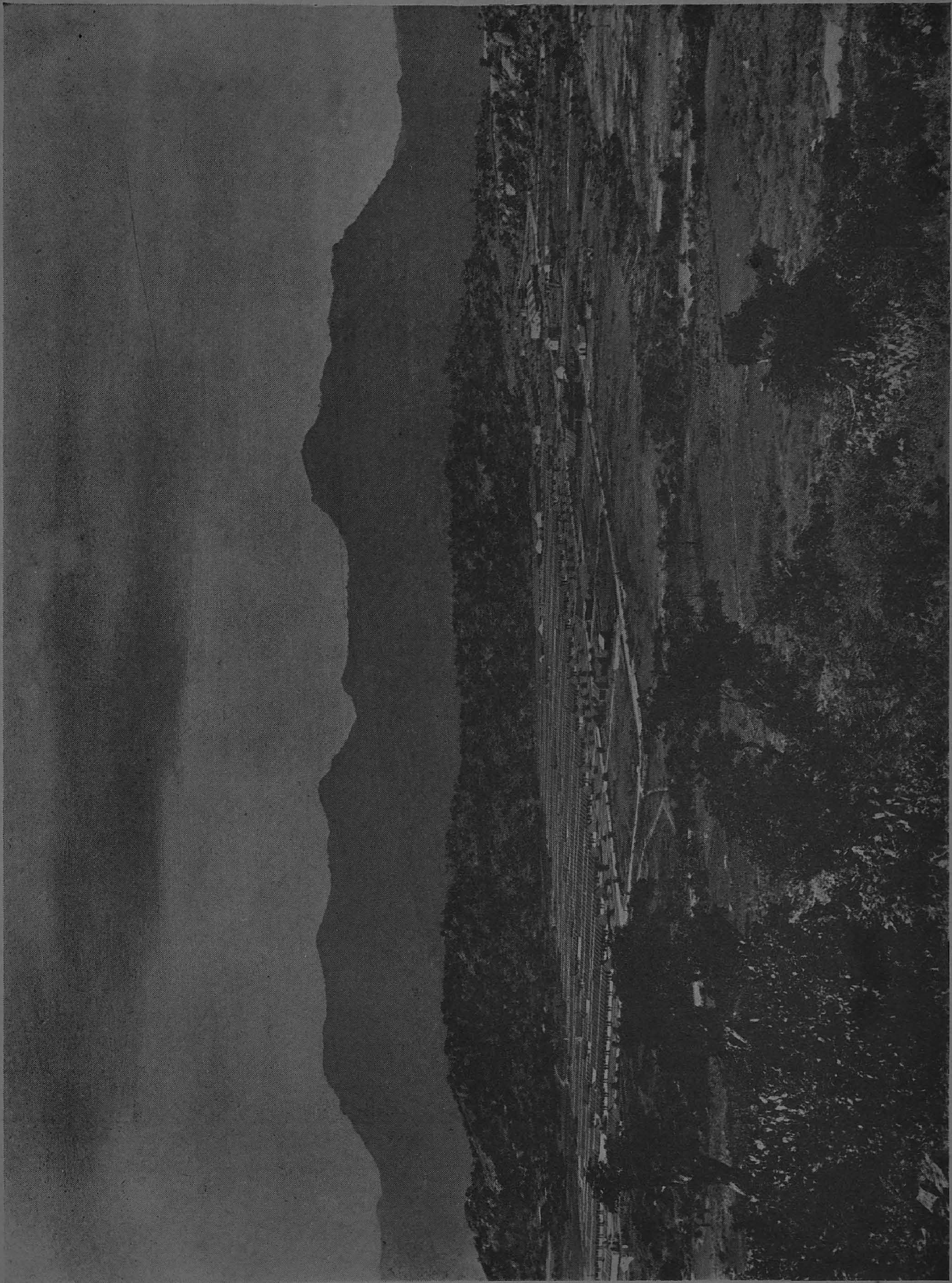
District.	Groundnut.	Cotton. Irrigated.	Cotton. Unirrigated.
	Acres.	Acres.	Acres.
Salem	152,009	10,966	29,822
Coimbatore	184,747	82,508	206,578

The possibilities of the oils and fats industries and the scope for the setting up of textile mills have been fully discussed in pages 32-39 of this publication. From Mettur to Bhavani, a distance of 26 miles on the Mettur-Erode road, cotton, tobacco and turmeric are the prevailing crops, and the ryots carry on a large trade in tobacco with Mysore and adjoining tracts. In the Mettur taluk, the principal crops are cumbu, gram, samai, ragi, groundnut, cholam, gingelly, paddy, chillies and cotton. In the sewage farm at Mettur, plantains, tobacco, cotton, groundnut, fodder, cholam and fodder grass have been successfully raised. From the results obtained from the farm, the possibility of raising industrial crops in the area by means of lift irrigation seems to be clearly demonstrated. The yield has no doubt been particularly good by reason of the use of the available sewage water in the farm, but if allowance is made for the fertility due to sewage irrigation, the soil appears to be well suited for the raising of industrial crops such as cotton and tobacco. In the Salem district there are extensive deposits of magnetic iron ore and magnesite to which reference will be found in pages 47-50.

IRRIGATION BY ELECTRIC PUMPING.

OF the rains which fall during the monsoon, part is absorbed into the ground while the rest flows on the surface in the form of streams and rivers. Irrigation up to the present has consisted mainly of the regulated use of this surface drainage, but the great sub-soil supply of absorbed water is for all practical purposes untapped. The comparatively small number of acres irrigated from wells in this Presidency shows that only a limited use has been made of the great supply underneath. It is obvious therefore that if only more wells could be dug, and the water lifted cheaply, agriculture would, to a great extent, become independent of the vagaries of the weather. Electric pumping for irrigation has been initiated in the State of Mysore with, it is understood, encouraging results and a considerable measure of success in this direction has also been achieved in the Punjab and the United Provinces. The availability of cheap electric power at Mettur suggests the possibility of sinking wells along the margin of the river, as well as in the vicinity of the transmission lines, and the carrying on of irrigation by means of motor pumps run by electric power. The current could be carried across the country to the points at which the power is required where receiving stations could be established and the current transformed down to a reasonable pressure and from the sub-stations, radiate to the mills and irrigation wells in the vicinity at which motors would be installed to drive the various machines and pumps. The provision of wells on the banks of the river with pumps run by electric power does not seem impracticable, although it will be a matter for careful investigation within what area it would be advantageous to set up such electric pumping installations.

It may be possible to provide for irrigation by electric pumping from a group of wells in suitable areas within the radius served by the electric supply scheme, whilst it is conceivable that large areas of land could be brought under industrial crops thus facilitating industrial development in the neighbourhood of Mettur. The possibility of raising industrial crops by means of lift irrigation seems to have been clearly demonstrated at the Mettur sewage farm, the experience of which goes to show that the soil is well suited for the raising of industrial crops.



General View of Salem Camp.

AVAILABILITY OF SITES AND LAND FOR INDUSTRIAL MILLS AND FACTORIES.

AS stated in an earlier part of this pamphlet, and as will be seen clearly from the layout plan showing the Project Headworks, on pages 10 and 11 the settlement area comprises the Mettur township on the right bank of the river Cauvery and the Salem Camp on the left bank, a girder bridge across the Cauvery connecting the two portions. Suitable land for factory sites and manufacturing purposes is available both on the Mettur and Salem sides of the Cauvery and could be secured at reasonable prices. It is not possible to state definitely at present at what price land could be made available for industrialists but the price of plots will, judging from the wide variation in the cost of acquisition, vary considerably. It can however be stated with some degree of assurance that choice industrial sites will be available at prices up to Rs. 250 per acre. In fact, the cost of acquisition including trees, wells and houses, gave an average rate of Rs. 150 per acre. On the Mettur side, plots suitable for industrial purposes could probably be obtained on the river bank, but factories on this side, although connected by road, would not be in direct railway communication. It is possible therefore that the Salem side may be preferred for the larger factories which it may be decided to set up, as facilities would be available there for laying railway sidings in reasonable proximity to the railway station, while the water required for industrial purposes could, as already stated, be pumped from the river or drawn, during part of the year, from the escape on its way back into the river. In addition to the Government land on the Salem side, suitable factory sites are also available on land owned by mirasidars, from whom it should be possible to acquire plots at about Rs. 250 per acre.

The red and gravel subsoil of the area is very suitable for building construction, and foundations of structures are from 3 to 5 feet. The cost of building ranges from Rs. 4 per square foot for single floor buildings to Rs. 8 per square foot for double-storied buildings.

SCOPE FOR THE ESTABLISHMENT OF INDUSTRIES.

(A) COTTAGE INDUSTRIES.

ONE of the main difficulties which has tended to restrict the development of industries in South India has been the high price and scarcity of fuel, but the position in this respect will be altered greatly for the better in the areas affected when electric power is available from the Mettur and Pykara projects. When cheap electricity becomes available, it should be possible to greatly develop, in what are to-day purely rural areas, small scale industries for working up into manufactured or semi-manufactured form the agricultural products of the province and thus to improve the economic condition of the villages with a consequent increase in the amenities of life on the countryside. Electricity, where available at a reasonable price, as will be the case in the Mettur area, will provide greatly improved facilities for the development of rural tracts. Electric power can be used for such varied purposes as pumping, sawing, fodder cutting and grinding, rice hulling, groundnut decorticating, oil milling, cotton ginning, bone-crushing, sugar-cane crushing and sugar manufacture.

The development of textile industries in the home will also be fostered by a cheap electric supply and the following home industries of this character may be mentioned :—

(1) Single power loom for cotton weaving.
(2) Single power loom for silk weaving.
(3) Single power knitting machine for making socks.
(4) Single power circular knitting machine for making banians with artificial silk.
(5) Single power Barfus loom for mesh banians.
(6) Power warp preparation factory for supply of warp to knitting machines.
(7) Power warp preparation for supply of warp to cottage cotton power looms.
(8) Power warp preparation for supply of warp to cottage silk power looms.
(9) Dyeing and stencil printing.

Again, the facilities that will be afforded in the Mettur area, when the project is completed and cheap electricity is available, would appear to offer scope for the setting up of small textile factories of the following descriptions :—

(1) Cotton power looms of 20 looms unit.
(2) Silk power looms of 20 looms unit.
(3) Small factory for the preparation of tapes, ribbons, shoe-laces, saree borders and similar articles.
(4) Warp preparation factory for supply of warp to small scale cotton factories.
(5) Silk throwing plant for supply of yarn to small scale silk factories.

(6) Wool spinning plant.

(7) Knitting factories for socks, banians, fish nets, and mosquito curtain cloths.

(8) Dyeing factory.

(9) Central carding factory for distributing slivers to cotton spinners.

(10) Factory for the manufacture of knitting healds.

(11) Factory for the manufacture of reeds.

(12) Factory for the manufacture of appliances such as jacquards, dobbies and slays, jacquard cards, shuttles, pirns, bobbins, etc.

Approximate financial statements in respect of most of the above industries have been worked out, and copies can be obtained from the Director of Industries on application.

(B) TEXTILE MILLS.—COTTON SPINNING AND WEAVING MILLS.

In view of the fact that a considerable proportion of the raw cotton produced in the Madras Presidency is exported, there is considerable scope for the establishment of additional power spinning and weaving mills. In the Madras Presidency, the cultivation of cotton is largely carried on in the districts of Tinnevelly, Ramnad, Madura, Coimbatore, Trichinopoly, Salem, Cuddapah, Anantapur, Bellary, Nellore, Kurnool, Guntur, Kistna, Godavari and Vizagapatam. Mettur is situated in the Salem district and is bordered by the Coimbatore district. The trade names of the several varieties of cotton grown in the Madras Presidency are 'Cambodias,' 'Tinnevellies,' 'Salems,' 'Northerns and Westerns,' and 'Cocanadas.' 'Cambodias' are grown in the districts of Trichinopoly and portions of Coimbatore and Madura district; 'Tinnevellies' in the districts of Tinnevelly, Ramnad, and portions of Madura; 'Salems' (Uppam) in the Salem district and portions of Coimbatore district; 'Northerns and Westerns' in the districts of Bellary, Kurnool, Anantapur, Cuddapah and Chittoor and 'Cocanadas' in the districts of Kistna and Guntur. Of the Southern India cottons, 'Tinnevellies' are well suited for the production of 40s counts and below, whilst others are suitable for 24s counts and below. The Northern staple is $\frac{7}{8}''$, the Eastern $\frac{3}{4}''$, the Cocanada $\frac{5}{8}''$ to $\frac{7}{8}''$, the Karunganni $\frac{7}{8}''$, the Tinnevelly $\frac{3}{4}$ to $\frac{7}{8}''$ and the Salem $\frac{3}{4}''$.

The acreages under each variety and the production in bales are shown in the following table :—

1930-31.

Trade name.	Area in acres.	Yield in bales of 400 lb. each.
Cambodias	243,600	87,690
Tinnevellies	524,800	128,550
Salems (Uppam)	159,400	33,810
Nadam and Bourbon	41,300	1,790
Northerns and Westerns	920,950	101,460
Cocanadas	163,500	25,290
Others	17,800	2,300

There are about 2,500,000 acres of land normally under cotton cultivation in the Madras Presidency, and the normal annual yield is about 500,000 bales of 400 lb. each.

The average annual imports of Madras during the last few years have been 7 million lb. of yarn and 70 million yards of cotton piece-goods, and there can be no question that having regard to the quantity of cotton available in the Province and the market for yarn and piece-goods in it, there is considerable scope for the setting up of additional spinning and weaving mills. There are at present only six or seven weaving mills in the Presidency employing a total of nearly 5,000 looms. The number of spinning mills is 22 and new mills are under construction or projected. The spinning mills employ at present over seven and a half lakhs of spindles.

It will now be convenient to consider under various heads whether the conditions precedent to the establishment and profitable operation of cotton mills exist in the Mettur area. The essential conditions which a site for a cotton mill should satisfy are—

(a) Proximity to cotton-producing tracts.
(b) Availability of power at a reasonable rate.
(c) Transport facilities.
(d) Ample supply of labour.
(e) Sufficient water.
(f) Sufficiently humid climate.
(g) Proximity to markets for the disposal of products.
(h) Suitable areas of land for the erection of factory buildings.

(a) Proximity to cotton-producing tracts.—Mettur is in the Salem district. As already stated, cotton suitable for 24s and below is grown in the district of Salem and in the adjacent district of Coimbatore, whilst Mettur is in railway communication with other important cotton-growing districts such as Trichinopoly, Madura, Ramnad and Tinnevelly as well as with other districts further afield.

(b) Availability of power at a reasonable rate.—It has been shown on page 25 that the cost of power at Mettur will probably range from ·40 to ·60 anna per unit and that an ample supply of water will be available for all purposes.

(c) Transport facilities.—These, which have been described in the Introduction, page 6, as well as on page 13, appear to be favourable.

(d) Ample supply of labour.—There will be a large organized labour force in existence at Mettur on the completion of the project which, after training, would no doubt be suitable for employment in mills and factories. The nucleus of the trained labour for textile mills could be drawn from Coimbatore and other cotton mill centres.

(e) Sufficient water.—Water for industrial purposes could, as stated on page 24, be obtained in almost any quantity from the river Cauvery. It cannot

definitely be stated at what price such water will be available, but it could probably be supplied at about Rs. 3 per 1,000 cubic yards, a proportionate rebate being allowed for water returned to the river properly purified to the satisfaction of the health authorities.

(f) The climatic conditions of Mettur have been fully discussed on page 22 and in Appendix B will be found an extract from the weather reports of the rainfall and evaporation station at Mettur. If necessary, mechanical humidifiers could be installed, although as pointed out elsewhere, the waterspread which will be formed on the completion of the project will almost certainly render the climate more humid and thus more suitable for textile factories.

(g) The distances from Mettur to Salem, Erode, Coimbatore and Madras are 26, 35, 81 and 233 miles respectively. The cloth produced by weaving mills in Mettur should be able to find a sale in Madras and other important consuming centres. If cheap yarn is produced by spinning mills set up at Mettur, it should be readily absorbed by the handloom weavers in the various districts of the Presidency with which Mettur is in road and rail communication.

(h) On the Salem side of the river suitable factory sites are available near the railway station and could be purchased from Government or from private owners.

The chief items in the manufacturing costs of a cotton mill, excluding raw materials, are labour and power. It is generally recognized that in order to obtain the best results and maximum production from spinning and weaving machinery, it is necessary to apply an even turning moment at the driving shaft of the machine free from cyclical irregularities and to maintain a close speed regulation. In a mill supplied with power produced by a reciprocating engine, cyclical irregularities in the speed of productive machinery must occur. A rapid increase in the use of electric power in the textile industries is taking place in all countries and the majority of the machinery now turned out is made for motor drive. With electric drive increased productive efficiency as also a better product—whether it be yarn or cloth—could be obtained. Mettur would therefore appear to offer special facilities for the setting up of cotton mills by reason of its cheap power and other advantages.

Approximate financial statements in respect of (a) cotton spinning mill of 20,000 spindles, (b) cotton spinning and weaving mill with 20,000 spindles and 450 looms, (c) cotton spinning, weaving and bleaching, dyeing and finishing mill, (d) warp preparation and distribution factory, (e) central bleaching, dyeing and finishing factory, and (f) cotton waste spinning factory, have been drawn up and copies can be obtained on request. It is estimated that the approximate cost of turning out 1 lb. of yarn would be about As. 9-2 and that the cost of weaving one yard of cloth would be about As. 3-3.

Dyeing factory.—If spinning mills are set up in the Mettur area for the production of yarn, and weaving mills for the production of cloth, there should be scope

for the establishment of bleaching, dyeing and finishing plants as adjuncts to such mills. The essential requisites for a dyeing factory are—

(a) Cheap power,
(b) Adequate supply of suitable water,
(c) Skilled labour, and
(d) Availability of yarn and cloth for dyeing.

Factors (a) and (b) will be present at Mettur, the permanent hardness being only two parts per 100,000. The requisite skilled labour could be attracted to the spot while, if spinning and weaving mills are set up, supplies of yarn and cloth for dyeing will be available.

It is estimated that a small factory at Mettur turning out 12,500 lb. of dyed yarn per month should be able to produce dyed yarn at 8 annas per lb. There would seem to be scope for a small dyeing and aerograph printing concern. Detailed particulars of a factory for producing 150 lb. of dyed yarn per day at six annas a lb., and ten printed sarees of 8 yards each at Rs. 12 a saree, may be obtained, on application.

Silk industry.—The manufacture of silk goods is by no means an unimportant section of the handloom weaving industry, while silk enters into combination with cotton in a number of varieties of cloth. India produces from one and a half to two million pounds of raw silk annually and also imports from China and other countries about an equal quantity. The magnitude of the industry may be gauged from the fact that in the Kollegal taluk of the Coimbatore district 25 lakhs of rupees' worth of raw silk is manufactured annually. In addition to this quantity about a crore of rupees' worth of raw silk is imported into the Madras Presidency from other parts of India and from foreign countries and the whole of this quantity in addition to the silk produced in Kollegal is used by the weavers. Raw silk is at the very outset a fine yarn, but it requires doubling and twisting so as to produce a thread sufficiently thick to stand the strain involved in the process of weaving. If therefore twisted silk is produced at Mettur with the aid of the facilities available there, it should find a ready sale amongst the handloom weavers of the Presidency. In fact, the establishment of silk throwing factories is essential for the development of power loom silk weaving on a small or large scale in this Presidency. In the case of a factory of 20 silk power looms producing per month of 25 days, 7,500 yards 48 inches wide, 100 ends and 120 picks, it is estimated that the cost of production of one yard of silk at Mettur would be As. 3–3. The cost of production of 1 lb. of twisted silk will be about Rs. 1–9–0. Financial statements for small factories can be obtained on request.

Hosiery industry.—If spinning and dyeing concerns are started in the area, Mettur with its cheap electric power would seem to afford scope for the establishment of well-conducted power-driven hosiery factories as the necessary supplies of yarn could be obtained from the spinning and dyeing mills. The market for hosiery goods in India is a growing one, only the fringe of the potential demand

having yet been touched. India is Japan's principal customer, importing knitted goods from that country to the extent of over 3,300,000 dozen in 1929. It is estimated that in the case of a factory producing per month 100 dozen socks, 1,250 yards mesh and 1,500 yards netting, the cost of production would be—

	Rs.	a.	p.
1 dozen socks	1	6	0
1 yard curtain or mesh	0	2	3·5
1 yard fish netting	0	2	4·5

The cost of producing 100 dozen cotton socks per month on a power-driven circular knitting machine would be about Rs. 1–10–1 per one dozen socks. On the basis of an output of 2,250 yards per month one yard of artificial silk banian cloth could be produced at an estimated cost of 9 pies, mesh banian cloth could be manufactured on a Rashel loom, 96″ wide with 12 needles, at a cost of about 2 as. $3\frac{1}{3}$ ps. per yard. Financial statements for hosiery mills have been worked out and copies can be obtained from the Director of Industries on application.

(C) OIL SEED CRUSHING INDUSTRY WITH PARTICULAR REFERENCE TO THE MANUFACTURE OF VEGETABLE FATS BY THE HYDROGENATION PROCESS AT METTUR.

Oil seeds are of great economic importance to the Madras Presidency owing to the variety of the seeds and the extent of their production. Only a very small percentage, however, of the annual outturn of oil seeds is converted into oil, the greater portion being exported as such to foreign countries. In the year 1929–30 the value of exports of seeds amounted to Rs. 1,412·30 lakhs or 33 per cent of the value of the total foreign export trade of the Presidency in Indian produce and manufactures. The value of the foreign exports of groundnuts during 1929–30 amounted to Rs. 1,338·97 lakhs representing 30 per cent of the foreign export trade.

The exploitation of the vast oil seed resources of the Presidency must depend to a great extent on general industrial development and the setting up of factories utilizing vegetable oils as a raw material. Soap factories are a case in point, as every additional soap factory that is established increases the demand for groundnut and coconut oil. A still more important potential outlet for vegetable oil lies in the manufacture in India of vegetable ghee on a large scale. If the manufacture of pure artificial ghee from vegetable oil is developed in India, it would result in the utilization in the country itself of an increasing quantity of the oil seeds produced in the Presidency and the lowering to the public of the price of ghee and other fats. An increased quantity of oil-cake would also become available to the ryots at a cheaper price for use as manure and the soil would consequently be enriched. Mettur would appear to be a suitable location for the establishment of a factory for the manufacture of vegetable fats by the hydrogenation process, as the main road to Madras from Calicut will pass through it, while it is in railway communication with Salem. In virtue of its proximity to such centres as Erode, Coimbatore, Pollachi and Palghat on the West Coast, a factory at Mettur would be able to secure almost all kinds of vegetable oils and fish oil in

any quantity. If an export trade is developed, shipments can be made through the ports of Madras, Calicut and Cochin. An ample supply of water is assured while electricity will be available at a very favourable rate.

In view of the suitability of Mettur for the establishment of a hydrogenation factory, it may be worth while to discuss the possibilities of such manufacture. The hydrogenation industry is strongly established in Europe and America and hardened fats prepared from vegetable oils and fish oils have, owing to their cheapness, now almost entirely replaced the use of mutton and beef tallow in soap factories in Europe. In America, there is a considerable production of hardened fats. In India there should be undoubted scope for the employment of the hydrogenation process, for, not only are the requisite natural oils available, but there is a good market for the products. The use of beef fat is objected to by Hindus and pig fat (lard) by Muhammadans. There should therefore be a steady and growing demand for hardened fats both for use in the manufacture of toilet soaps and as a suitable substitute for ghee. At present Indian soap manufacturers have to depend largely upon tallow (beef and mutton) in the manufacture of high class toilet soap. Local tallow is of very indifferent quality and is extremely wasteful to refine, while the quantity available is neither steady nor sufficient. On the other hand, tallow imported from Australia, New Zealand and England is very expensive. Soap manufacturers in India who have to use at present an expensive tallow for high class soap are therefore placed at a disadvantage in competing with soap makers in Europe. An assured and cheap supply of a suitable tallow substitute prepared from vegetable oils in this country would give a decided impetus to the development of the toilet soap industry.

Among the other uses of hardened fats, the following are the most important :—

(1) Artificial ghee, ghee substitutes, margarine.
(2) Lubricants.
(3) Candles.
(4) Insulating compositions.
(5) In the tanning of leather.

(1) At present pure ghee is not available in India in sufficient quantities and the price also is very high, while most of the bazaar ghee is unwholesome and grossly adulterated often with deleterious substances. As a result, ghee substitutes manufactured in Europe are finding an increasing market in India. Although such products are not equal to pure ghee in the matter of flavour, taste and nutritive value, they are harmless and are infinitely superior to the so-called ghee vended in the bazaars. The artificial ghee factories in Europe and America are now said to be adding something in the nature of a substance rich in vitamin to hardened fats in order to make up for the deficiency of this vital element which is necessary, though in a minute quantity, for nutrition. These ghee substitutes are simply hardened vegetable fats or mixtures of such hardened fats and liquid vegetable oils such as coconut oil, sesame oil or groundnut oil blended with a small admixture

of butter, fat or even ghee. In Europe hardened fats are now even replacing tallow and lard as shortening material in the manufacture of bread.

(2) Formerly tallow was commonly used in the manufacture of lubricants, but now hardened fish oil is gradually taking the place of tallow owing to its cheapness. An outlet for hardened fats should be found in the form of axle grease on railways as also in mills and factories which use tallow for the lubrication of machinery.

(3) Hardened fats are used in Europe in the manufacture of candles. Stearic acid obtained by the ordinary process of fat splitting and distillation is more expensive than hardened fats, as the process of preparing stearic acid is very elaborate and the output limited. For use in tropical countries, candles made from hardened fats are preferable to those made from mineral wax of a low melting point, as the latter, though cheap, are wasteful.

(4) As insulating composition, hardened fats are extensively used in Europe.

(5) In the tanning industry, stearine produced by hydrogenation is used in place of olea-stearine. For stuffing harness leather, belting and other heavy leather, hardened fat is gradually taking the place of tallow.

It will be seen from the foregoing that hardened fats are used for a variety of purposes and that there should be a growing demand for such fats in India. India is importing annually about 23,000 tons of vegetable fats, chiefly from the Netherlands, most of which is consumed as edible fats or substitutes for ghee. The following statement shows the imports during the last two years from the various countries into British India and into the Madras Presidency :—

Vegetable Fats and Vegetable Ghee imported into British India and Madras Presidency.

Countries.	British India.				Madras Presidency.			
	1928–29.		1929–30.		1929–30.		1930–31.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
United Kingdom	2,172	92,929	559	20,181	51	2,330	83	3,870
Aden and Dependencies ...	...	...	...	...	1	32	...	...
Ceylon	4	115	...	...	...	...	...	...
Other British Possessions.	3	120	15	1,101	...	...	...	...
Straits Settlements ...	...	...	...	...	12	981	2	69
Denmark	55	2,061	2,086	78,005	1,647	62,160	2,102	72,800
Germany	6,799	2,44,313	14,637	5,98,273	...	...	6,429	2,50,051
Netherlands	400,873	1,54,63,718	290,565	1,08,74,785	35,152	14,14,313	38,842	15,14,569
Belgium	47,334	18,71,090	13,136	4,47,991	810	26,791	1,330	48,511
Luxemberg	35	1,500	...	...	...	...	...	...
France	54	1,345	82	3,160	...	...	644	25,050
Italy	16	680	...	...	...	...	...	...
Java	796	27,875	8	220	...	...	...	...
United States of America via Atlantic Coast.	33	1,316	2	125	...	...	lb. 3	4
" Pacific Coast.	10	290	...	...	...	...	...	...
Iraq	...	..	36	1,319	...	...	...	...
Total ...	458,184	1,77,27,352	321,126	1,20,05,160	37,673	15,06,607	49,432	19,14,924

On the basis of the figures embodied in the foregoing statement, the cost per cwt. of hardened fat works out on an average to Rs. 38–4–0.

There already exists a good market in India for hardened fats, and the demand is likely steadily to increase. The possibility of developing an export trade in hardened fats should not be overlooked as such products in the form of solid slabs could be easily packed and shipped. The difficulty attending packing, liability of oil to become rancid, losses due to leakage, higher freight rates and other causes which now operates as an impediment to the successful development of the export of oil from India are factors which are absent in the case of shipment of hardened fats. The large quantity of oil consumed by the hydrogenation industry would give an impetus to the oil milling industry in the Presidency and to the cultivation of oil seeds which is passing through a difficult time. An hydrogenation factory at Mettur could either set up its own oil crushing mill or draw its supplies from oil mills in the surrounding country.

There are several types of hydrogenation plant and hydrogen producing plant in use in Europe and America. The main sections of the plant are for—

(1) Production of catalyst.
(2) The recovery of catalyst.
(3) Production of hydrogen.
(4) Hardening.

The hydrogen generating plant is usually based on the iron contact process, but as cheap electric current will be available at Mettur, the electrolytic method of generating hydrogen would doubtless be adopted.

The Director of Industries, Post Box 432, Chepauk, Madras, will be pleased to answer any enquiries in regard to the scope for the setting up of a hydrogenation factory in the Mettur area, and to furnish an estimate for a plant capable of an output of five tons per day as well as any additional data that may be required by prospective manufacturers.

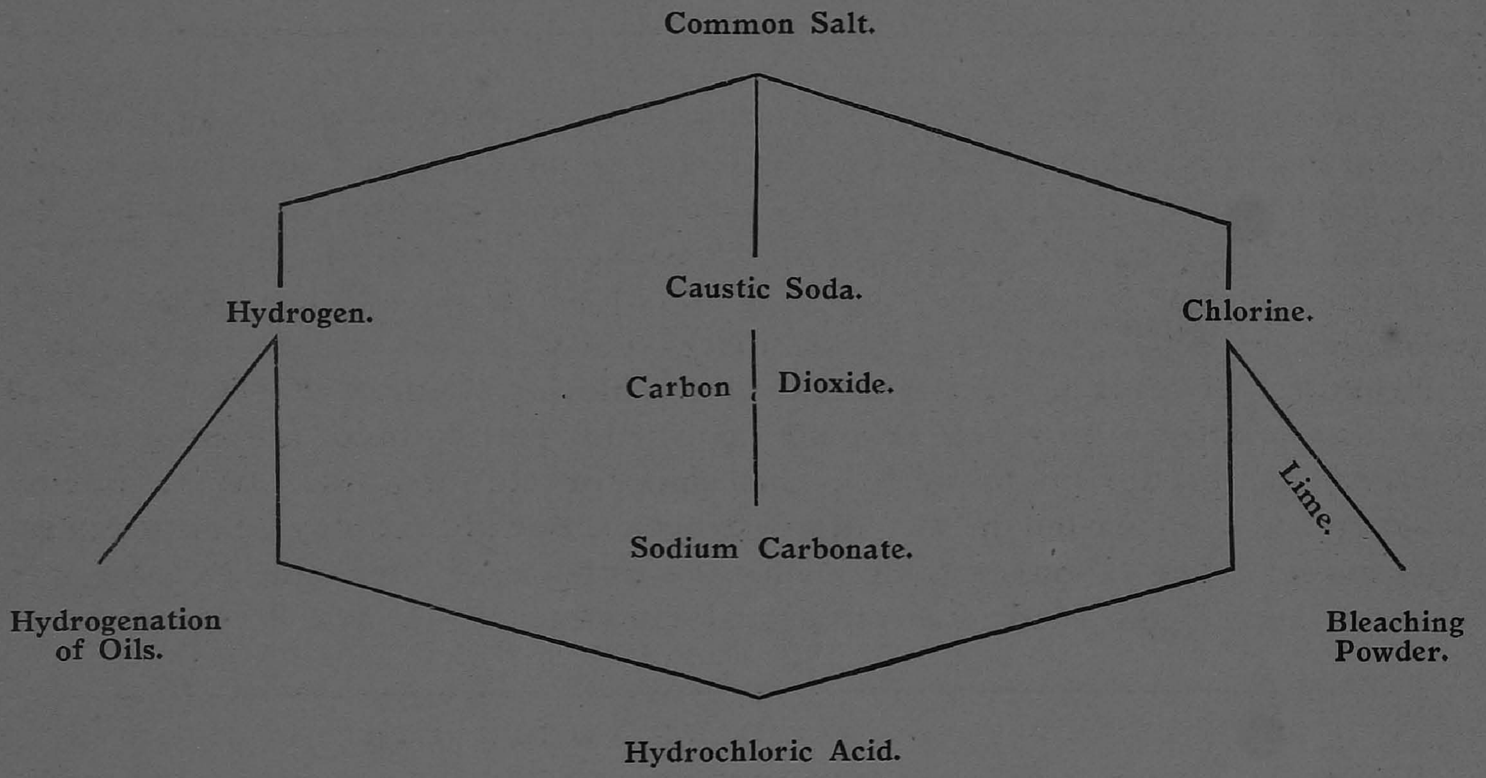
(D) GENERAL CHEMICAL INDUSTRIES.

The suitability of Madras as a centre for the manufacture of certain basic chemicals has been investigated from time to time, but the conclusion arrived at was that the prospect of the development of a heavy chemical industry in Madras was remote owing to the high cost of fuel. In any attempts to foster the development of chemical industries in India, attention should be directed in the first instance to such industries as can utilize Indian raw materials now exported to foreign countries where they are worked up into various finished products. Under this category may be included the raw materials from which vegetable oils, artificial fats and feeding cakes are manufactured. The fact that during the next few years cheap electric power will be available in the Mettur area seems to justify a re-examination of the possibilities of establishing certain chemical industries in this Presidency. Second only to sulphuric acid in importance for

the development of chemical industries are the alkalies (sodium carbonate and sodium hydroxide), since little expansion of other industries can take place unless these chemicals are available at a low price. The question whether there is scope for the development of the alkali industry at Mettur would seem to merit examination. The bulk of the caustic soda now manufactured in America and Europe is produced electrolytically from aqueous solutions of common salt. The power for generating electricity is usually and most cheaply provided by water power and so the Niagara Falls in America and the waterfalls in Norway and other countries rich in water power are the main seats of this industry.

THE ALKALI INDUSTRY.

Electrolysis of salt solution.—The products obtained from the electrolysis of an aqueous solution of common salt are caustic soda solution, chlorine and hydrogen.



Caustic soda.—The caustic soda solution can be evaporated and caustic soda prepared. It finds a use in many industries including soap, textiles (mercerising of cotton), paper, dyeing and purification of petroleum and mineral oils. According to an authority on the subject, one-h.p. working for 24 hours yields about 6·6 kilograms of caustic soda and from say 10,000-h.p. therefore, the annual production of caustic soda would be about 450,000 cwt., or about two and a half times the quantity imported into India, and the common salt required for this purpose would be about 700,000 cwt. The caustic soda could also be converted into sodium carbonate or sodium bi-carbonate. About 600,000 cwt. of the former and 900,000 cwt. of the latter could be produced if 10,000-h.p. were utilized in the manufacture. The

imports of sodium bi-carbonate into India are about 110,000 cwt. In the table below the imports of sodium carbonate and caustic soda into (*a*) India and (*b*) the Madras Presidency during each of the last five years are shown :—

Year.	Sodium carbonate.				Caustic soda.			
	India.		Madras Presidency.		India.		Madras Presidency.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
1926–27 ...	990,178	58,34,215	65,292	3,62,493	160,834	18,06,452	28,659	3,27,632
1927–28 ...	1,061,185	60,00,580	64,220	4,04,596	175,297	19,62,784	29,086	3,26,565
1928–29 ...	1,076,634	62,45,427	101,449	6,25,438	173,643	19,48,569	35,010	3,96,771
1929–30 ...	1,204,059	71,08,815	79,850	4,71,324	189,609	21,25,790	35,996	3,84,765
1930–31 ...	1,049,164	64,30,855	98,964	5,56,056	231,901	27,29,595	36,576	4,06,744

Chlorine.—The annual yield of chlorine from the electrolysis of common salt solution would be about 400,000 cwt. Chlorine is not imported into India to any appreciable extent. It can, however, be used for preparing bleaching powder, the other chemical required being lime which is available in the vicinity of Mettur. Bleaching powder is used for bleaching textiles and paper pulp, whilst large quantities are also required for the sterilization of water and for the preparation of hospital disinfectants. The 400,000 cwt. of chlorine would yield 600,000 cwt. of bleaching powder. As much chlorine as would be required for 100,000 cwt. of bleaching powder could perhaps be used for this purpose, the remaining quantity being converted firstly into hydrogen chloride and thence into hydrochloric acid. The following table shows the imports of bleaching powder into (*a*) India and (*b*) the Madras Presidency during each of the last five years :—

Year.	Imports of Bleaching Powder.			
	India.		Madras Presidency.	
	Quantity.	Value.	Quantity.	Value.
	Cwt.	Rs.	Cwt.	Rs.
1926–27	81,163	7,68,478	3,900	40,937
1927–28	100,440	8,84,861	4,240	54,319
1928–29	91,030	5,79,289	5,009	60,034
1929–30	99,309	7,05,287	4,825	74,968
1930–31	119,005	8,93,638	3,640	62,861

Hydrogen.—The annual production of hydrogen would be about 120,000 cwt. and a portion of this quantity could be used for the hydrogenation of oils to which reference has been made elsewhere in this pamphlet. The balance of the hydrogen could be converted into hydrochloric acid.

Fixation of nitrogen.—In this process the nitrogen of the atmosphere is made to combine with elements under definite conditions of temperature and pressure resulting in the production of compounds such as cyanamide, ammonia and nitric acid.

Cyanamide.—This can be prepared by passing nitrogen over calcium carbide or a mixture of lime and coke. The nitrogen is prepared by the fractionation of liquid air in a Linde machine. Cyanamide works have been established in Norway, America, Italy, Germany and Japan. The Indian Sugar Committee considered that the cyanamide process of fixation of nitrogen is the one which offers the best prospects of success and on page 90 of their report appears a statement to the following effect : " It is estimated that carbide works which pay £2 to £2 10s. per h.p. a year for power and average prices for coke, lime and nitrogen can produce cyanamide at a profit." The present selling price of cyanamide is about £10 per ton. Doctors Sudborough and Simonsen have expressed the opinion that the erection of electric plants for the production of cyanamide and metallic nitrates from atmospheric nitrogen for manurial purposes is not a commercial proposition, unless it is shown that these can be manufactured in India at a figure which would admit of their being exported to Ceylon, the Malay Peninsula and the Dutch East Indies so as to compete with European, American or even Japanese products. It is perhaps doubtful whether the manufacture of cyanamide in India can at present be considered as a commercial proposition.

Ammonia and ammonium salts.—Ammonia can be prepared from atmospheric nitrogen by (*a*) the cyanamide process and (*b*) the Haber process. In the cyanamide process ammonia is obtained by the action of steam or superheated water on calcium cyanamide prepared as described above. In the Haber process, hydrogen is made to combine with the atmospheric nitrogen so as to produce ammonia.

Ammonia, by whatever method or process it is prepared, has to be converted into ammonium sulphate for manurial purposes. The difficulty attending the manufacture of ammonium sulphate is that in the present circumstances only very large units can be expected to pay even under the most favourable conditions and it is a question for investigation by chemical manufacturers whether a factory established in India would be in a position to produce synthetic nitrogenous fertilizers at a price less than that at which they could be imported. It may be mentioned, however, that the demand for these fertilizers is steadily growing. A few years ago, the Agricultural Department in Madras supplied fertilizers to planters only, but to-day the demand in the villages is not inconsiderable. Very many of the difficulties attending the application of the manure have been dealt with and when they have been further overcome the market should expand to a marked extent.

The increased demand for chemical manures has no doubt been assisted by the considerable reduction in price which has taken place during the last few years. The table below shows the imports and exports of ammonium sulphate into and from (*a*) India and (*b*) Madras Presidency during each of the last five years. The rapidity of the growth in the imports of these manures during the last three years will be noted :—

Year.	Imports and Exports of Ammonium Sulphate.							
	Imports.				Exports.			
	India.		Madras Presidency.		India.		Madras Presidency.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Tons.	Rs.
1926–27 ...	2,684	4,75,892	92	16,853	4,304	7,10,661	...	...
1927–28 ...	3,915	6,42,390	821	1,36,173	3,756	6,39,109	...	...
1928–29 ...	17,993	28,53,847	10,800	17,56,583	10	2,050	...	...
1929–30 ...	24,819	36,26,606	12,732	18,98,342	...	...	...	...
1930–31 ...	19,851	26,52,471	7,979	10,84,625	4,850	5,62,600	...	...

The Director of Industries will be glad to supply any information which may be required by chemical manufacturers in regard to the possibility of establishing the chemical industries referred to at Mettur.

(E) PULP AND PAPER INDUSTRY

Mettur would appear to offer considerable scope for the establishment of a pulp or paper industry. In view of the heavy capital requirements of the industry, the first essential is a continuous and assured supply of the raw material. Investigations recently undertaken by the Forest Department indicate that a secure supply of bamboos exists and that the fundamental problem of getting the supply to a mill at Mettur would not present insuperable difficulty. The raw material occurs within forty miles of Mettur and bamboos in exploitable quantities are found over an aggregate of 35,000 acres in the reserves of Ramapuram Forest range, whilst an additional area of 5,000 acres carries bamboos in the unreserves. If a reasonable reduction is made in the gross bamboo area, it may safely be estimated that 25,000 acres contain dense bamboos. The Ramapuram bamboos are not, however, the only possible source of raw material for a pulp or paper mill at Mettur. There are extensive bamboo areas in Bargur range which are within easy access of the Palar and the Cauvery, and bamboos from this range could be floated down to Mettur. On the Palamalai hill, which adjoins Mettur, 3,000 acres contain bamboos. The average lead from this area to Mettur is under ten miles. There are in addition vast bamboo tracts in Bargur and Bhavani ranges, the outturn

from which could be carted down to Mettur. It is probable that similar bamboo areas exist on the Salem side of the Cauvery. According to Mr. Raitt, the authority on the utilization of bamboo for pulp and paper manufacture, a plant producing 10,000 tons of pulp is the smallest that would be economically feasible. Thus a sustained annual supply of 22,500 tons of air dry bamboos is the minimum required to run a pulp mill at a profit. If, however, a paper mill instead of a pulp mill were established at Mettur a smaller unit producing about 5,000 tons of paper would be an economic proposition and in this case the minimum raw material required would be only 11,660 tons. The Forest Department estimates that from the Ramapuram range alone an annual outturn of 28,000 tons of air dry bamboo could be obtained which in itself should be sufficient to support a 10,000 ton pulp plant. It will be evident, therefore, that a pulp or paper mill at Mettur would be extremely unlikely to fail for want of raw material.

Transport conditions.—The bamboo tracts in Ramapuram range are disposed round a central point called Uthupium within a radius of six miles. This point lies at an elevation of 1,500 feet and would form a convenient base for the bamboo exploitation operations as the river Cauvery flows within ten miles of Uthupium. The road which would have to be constructed in order to transport bamboos to the river would pass through easy country and the cost of construction is not likely to exceed Rs. 2,500. An alternative course would be to construct a tramway between Uthupium and the rafting station. From the rafting station the bamboos would be rafted down the Cauvery to the mill at Mettur over a distance of a little more than twenty miles. It is possible that artificial propulsion of the rafts might be necessary on account of the absence of a current strong enough to move the rafts quickly above the dam. The scheme of extraction would therefore be as follows: Bamboos would be cut by coolies and dragged or carried by them to the collection depot at Uthupium. From Uthupium they would be transported in carts or trains running on a tramway down to the Cauvery, whence they would be rafted to Mettur.

Cost of extraction of bamboos.—The cost of a ton of air dry bamboo at works is estimated as follows :—

Item.	Cost. Rs.	a.	p.
1. Cost of felling 450 bamboos and transporting to collection depot for an average distance of 4 miles.	6	0	0
2. Cost of transport by carts for a distance of 10 miles from collection depot to rafting station (one cart will carry a ton).	2	8	0
3. Transport by rafts to works a distance of a little over 20 miles say ...	2	0	0
4. Contingencies	0	4	0
	10	12	0

Thus the total cost of one ton of air dry bamboo at works amounts to Rs. 10-12-0. Allowing a margin of 25 per cent, the equivalent of a ton of paper pulp will cost about Rs. 30-4-0. To this must be added the royalty payable to Government, say Re. 1 per ton of bamboo. Government would probably be willing to lease the bamboo area for a term of say 20 years.

Labour.—Labour is available in the local villages, though it is not perhaps likely to be sufficient for the bamboo extraction operations and it may be necessary to import additional labour. There should be no serious difficulty in regard to this, however, as the completion of the Mettur Project will throw large numbers of men out of employment and they will be available for the mill as well as for the collection of raw material. Coolies can always be obtained from the Salem side of the Cauvery.

Index Figure of Prime Costs.—As a ready means of ascertaining whether a project is a sound financial proposition or not, Mr. Raitt, the authority previously quoted, has prepared the following index figure consolidating the various items of cost for preparing a ton of pulp.

	Rs.	a.	p.
1. Two and a half tons of bamboo at Rs. 15 per ton	37	8	0
2. Four tons of fuel at Rs. 6 per ton	24	0	0
3. Three-fourth ton of lime stone at Rs. 8 per ton	6	0	0
4. One ton pulp freight to port	12	8	0

A mill at Mettur would have an advantage in respect of the price of the bamboo, whilst under fuel there should also be a saving as compared with Mr. Raitt's figures provided the electricity which will be available at Mettur is used for steam raising in the digesters as well as for power. Burnt limestone can be delivered at Mettur for about Rs. 28 per 100 cubic feet. The freight on a ton of pulp from Mettur to Madras would be Rs. 16-7-0.

Advantages afforded by Mettur for the pulp or paper industry.—The general factors favourable to the location of a pulp or paper mill at Mettur may be briefly summarized as follows :—

(i) The species of bamboo occurring in the area is almost exclusively *Dendrocalamus strictus* which is specially suitable as a raw material for pulp manufacture. The Forest Research Institute has demonstrated the suitability of bamboos generally as raw material for paper pulp and in particular of *Dendrocalamus strictus*, the local species of bamboos which is usually not subject to gregarious flowering.

(ii) From the Ramapuram Forest range alone it is estimated that at least 25,000 tons of dry bamboo annually could be extracted and delivered at mill site at Mettur for less than Rs. 15 a ton. An adequate and sustained supply of raw material at reasonable rates should therefore be assured.

(iii) River transport would be available for the greater part of the total lead right up to the mill.

(iv) As the proposed mill would be situated on the banks of the Cauvery, an inexhaustible supply of fresh water, an essential requirement of a paper or pulp mill, would be available.

(v) Cheap electric power is available. The cost of power at Mettur would range from 0·4 to 0·6 anna per K.W.H., whilst special rates will be allowed for industrial establishments guaranteeing an annual consumption of not less than 400,000 units.

(vi) Large quantities of limestone of the crystalline variety are available near (1) Mavelipalayam near Sankeri, 53 miles from Mettur, (2) Pakkanad, a village in Salem district 15 miles from Mettur by road, and (3) Anandampalayam, a village 15 miles from Mettur on the road to Bhavani.

(vii) As explained elsewhere, suitable plots of land for the erection of the main mill buildings are available at Mettur, whilst a large number of buildings suitable both for factory and residential accommodation will be available when the Mettur Project is completed.

(viii) As Mettur is on a broad gauge railway line, the import of chemicals, etc., and the export of the finished product should present no difficulty.

(ix) Tram lines, haulage engines and other industrial plant could probably be purchased cheaply from the Public Works Department on completion of the dam.

Relative advantages of pulp and paper manufacture.—Whether it would be possible to supply the existing manufacturing concerns in India with pulp from Mettur, or whether it would be practicable to export pulp to Japan and Australia in replacement of the considerable quantities which those countries import in normal times from Scandinavia is a matter for expert investigation. Similarly the question of the relative advantages of manufacturing pulp or paper at Mettur is one for decision by experts. The bulk of the trade is conducted in unbleached pulp, but in view of the fact that cheap power will be available at Mettur, it might be more advantageous to manufacture the bleached product. Should an alkali industry be started and bleaching powder produced at Mettur a bleached pulp or paper mill would of course be in a particularly advantageous position. Imported bleaching powder could, however, be delivered at Mettur at about Rs. 182 per ton. One of the advantages of manufacturing paper in preference to pulp is that the overhead and depreciation charges to be carried per ton of product can more easily be carried on the higher value of paper than on the lower value of pulp, and further it is perhaps easier to sell paper than pulp. If a paper mill were set up at Mettur, it should be possible to turn out (i) cream laid and other writing paper, (ii) white printings other than newsprint, (iii) wrapping and packing paper, (iv) badami paper and (v) brown paper of a satisfactory standard of quality. The imports of these and other varieties of paper (excluding newsprint) into the Madras Presidency by sea during the last three years appear to have averaged about 7,200 tons. The market for paper in this

Presidency is not at present large but though the average consumption of paper per head of the population is very low, there can be little doubt that the consumption will develop gradually in response to the growth of education.

The prospects of a pulp or paper mill at Mettur, utilizing mainly the bamboos of Ramapuram range in Kollegal Forest division as raw material, would seem to be reasonably promising. There is, as already shown, ample bamboo within economic reach of Mettur, whilst many other essential conditions appear to be favourable. The question is now under investigation and any information or additional data on the subject that may be required by prospective manufacturers can be obtained on request from the Director of Industries. The Chief Conservator of Forests will also be glad to supply maps of the bamboo area as well as charts showing the quantity of bamboo available in the several Forest ranges.

THE IRON ORES OF SALEM.

THE development of electric power on a large scale at Mettur and the consequent availability of a cheap supply a few years hence opens up the question of the exploitation of the Salem iron ores with power derived from the Mettur Project. The history of the attempts to manufacture iron by European processes in the Madras Presidency dates back to the early part of the last century. The presence of rich iron ores in the southern taluks of the Salem district and the existence of an ancient indigenous iron smelting industry in numerous centres of this area, an industry which though working with exceedingly crude appliances produced excellent wrought iron and steel, attracted attention so far back as 1818 when Mr. J. M. Heath of the Madras Civil Service conceived the idea that a profitable business could be established by the application of modern methods and machinery to the industry. After resigning the service, he obtained in 1830 from the East India Company, exclusive rights for carrying on operations throughout the Madras Presidency. Blast furnaces were erected at Porto Novo on the East Coast and though it was proved that excellent pig iron could be made from the Salem ores, commercial success was not achieved. A new Company styled the 'Porto Novo Steel and Iron Company' took over the furnaces and enlarged them, built others at Beypore on the West Coast and carried them on till 1849 but still unsuccessfully. Another Company styled 'The East India Iron Company' acquired the concern in 1853 and built furnaces at Tiruvannamalai and another at Pullampatti on the banks of the Cauvery in the Salem district. They made roads from Pullampatti to Kanjamalai which contains the most celebrated of the magnetic iron beds, carried the ore to the works on the river and smelted it there with charcoal brought by boats from Sholapadi 18 miles up the Cauvery. The Company commanded large capital and established foundries, puddling forges, rolling mills and even Bessemer steel converters. But it was not commercially successful and the operations

came to an end in 1867. Yet another attempt was made in 1875 by the Napier Foundry Company of Madras to establish an iron industry on a large scale, but with its failure in 1877 ended the last attempt to manufacture iron by European processes in the Madras Presidency. In 1895 the question of working the Salem iron ores again received attention. The construction of the railways which connected the Salem district with the East and West Coast and with the Singareni coal fields, the cheapening of ocean transit and the improvements by inventors generally in iron and steel making plant and in furnaces effecting considerable reduction in the cost of production introduced new factors in the situation. The Secretary of State submitted the question for the consideration of Mr. Jeremiah Head, a past President of the Institute of Mechanical Engineers, who went into the whole question very carefully. Mr. Head's conclusions which were arrived at after a study of the whole question were briefly: (1) that an export trade in Salem magnetite to European ports must 'for the present' be given up as impracticable as it could not be delivered at prices prevalent there except at a loss; (2) that charcoal pig iron could not be produced in the Salem district at a cost which would enable it to compete either there or at Madras with imported pig iron and (3) that the substitution of Singareni coal would not improve the chances of success. The question was revived in 1914 by Messrs. E. Gaudart and Company of Pondicherry. They obtained a mining lease over 4,369 acres in the Kanjamalai reserve forest for the purpose of working the iron ore. They extracted a small quantity of the ore and sent ten tons to France for a magnetic concentration test. The report was favourable, but the War prevented the working of the concession, and the lease was cancelled towards the end of 1916.

The electric iron smelting industry is well established in Sweden, such electric furnaces having been set up to replace the small charcoal blast furnaces in which high grade Swedish iron was formerly made. The substitution of the electric furnace in place of the charcoal blast furnace in Sweden was due to the necessity of cheapening the cost of production of pig iron since the cost of making the iron using cheap Swedish water power is less than in the blast furnaces. Swedish experience goes to show how vital the question of the quality of the ore becomes when it is dealt with in furnaces of small dimensions and yield. So far as the Salem ore is concerned, it has enjoyed a traditional reputation for high quality and has been held to be equal to the Scandinavian ore. The statements in the District Gazetteer that it is possible to obtain in Salem an almost inexhaustible supply of ores with an average of nearly 60 per cent of iron and that the ore contains no phosphorus or sulphur (which detract from its value for purposes where a high grade iron is required) represent the strength and vitality of this tradition. In 1914, when Messrs. Gaudart and Company of Pondicherry submitted the question of the quality of the ore to the Geological Survey, the opinion was expressed that the ore with an iron percentage of 50 to 60 occurred only in 'small pockets' or as veins, and referring to a previous analysis of a specimen which showed

a percentage of 39·02 of iron, it was thought that this represented the real crude ore of Kanjamalai, which anyone working the deposits on a large scale would have to deal with. Subsequently, in order to settle the question of the quality of the ore, a number of samples of iron ore from the Salem district which previously had been collected by Sir Thomas Holland were analysed by the Geological Survey of India. Of the six analyses that were made, two showed iron percentages between 67 and 69 while in the other four the iron was as low as 30 to 40. In 1925 three tons of Kanjamalai ore was, at the instance of M. Gaudart, subjected to extensive concentration trials by Messrs. Fried Krupp, and the results, which were distinctly promising, went to show that the ore could be improved by magnetic concentration as readily as similar Swedish and Norwegian ores. A sample of the powdered and concentrated ore was therefore submitted to the Geological Survey of India for opinion and when assayed gave 66·9 per cent of metallic iron. The Director of Geological Survey reported that the material was highly magnetic and evidently consisted of magnetite and that there was a concentration of 92·4 per cent Fe_3O_4. It was pointed out by the Director that any ore containing over 60 per cent of iron may be looked upon as first-grade ore, and that there is no question therefore of the grade of the Kanjamalai concentrates. The conclusion that emerges from a study of the documents bearing on the question of the development of the Salem iron ores is that the obstacle in the way of the success of these ventures was the difficulty of obtaining a continuous and sufficient supply of cheap fuel. In Mr. Head's report it is stated that the lack of cheap fuel is the main difficulty, while M. Gaudart has expressed a similar opinion. The availability of cheap power from Mettur which is only about 40 miles from Kanjamalai would therefore appear to justify a re-examination of the question and it would probably be well worth while for a prospective manufacturer to verify the existing data by arranging for a magnetic test to be carried out on a bulk sample of the ore. All possible facilities in this regard will be afforded to any firm of manufacturers who may be interested in the possibility of developing these deposits.

SALEM MAGNESITE.

THERE are very extensive deposits of some of the finest magnesite in the world in the Salem district, but although this mineral is usually considered to be of considerable value, the deposits do not appear to be worked to an extent at all comparable with their magnitude. This is due to a variety of causes, the chief of which appears to be the restricted demand both in the country itself and for export purposes. Though almost unlimited quantities of crude magnesite are available, it has not been possible so far to increase the demand for the material. The increase in the United States import duty on calcined magnesite in 1927 from 14 to 21 dollars per ton has had an adverse effect on the Salem magnesite industry, there having been a

reduction in the tonnage exported to that country, while the profit on the reduced shipments is said also to have declined. Unless therefore new outlets can be found for the mineral, the outlook for the industry in the Salem district does not appear to be particularly promising, although the demand in the country itself for magnesite in the form of floorings is expanding to a limited extent. Salem calcined magnesite is considered to be about the best in the world for magnesite composite floorings and other similar uses in the building industry. Dead-burnt magnesite, as used in steel furnaces and the manufacture of bricks therefor is in large demand, and there would seem to be possibilities in regard to the manufacture of this form of magnesite at Salem although a difficulty is that Salem magnesite is very pure and contains very little iron. Cupels for gold and silver assays are also manufactured in the Salem district from the material.

A possible use of magnesite is in the production of magnesium sulphate or epsom salt by treating the magnesite with sulphuric acid. Although magnesite is so cheap, the price of sulphuric acid is high and it is probable that a factory established at Mettur on a large scale could operate with a margin of profit only if a good price could be realized for the carbon-dioxide recovered in the process.

A new process is believed to have been evolved recently for the manufacture of magnesium metal from magnesite, and to this is due the increased demand for crude magnesite. Magnesium metal is lighter than aluminium and the demand for it is expected to be great. If the commercial possibilities of magnesium metal are established, it would seem well worth while for manufacturers to consider the setting up of a factory in the Salem district for the manufacture of the new metal with the aid of the cheap electric power available from the Mettur Hydro-Electric Project. It is understood that a market is already developing in fused pure magnesite, and it should be practicable to fuse such magnesite with cheap electrical power at Salem as is done in Switzerland.

ARCHIVES

APPENDIX A.

List of Buildings in the Mettur Settlement.

Mettur Camp.		No.
Engineer-in-Chief		1
Personal Assistant to the Chief Engineer (S.E. type)		1
Superintending Engineer (S.E. type)		1
European Executive Engineers		5
Indian Executive Engineers		2
Health Officer (Subdivisional Officer's type)		1
Subdivisional Officers in three different types for the use of junior and senior officers		16
Supervisors, 11 blocks (4 houses in each)		44
Higher grade clerks—Ten blocks (6 houses in each).		
,, Six independent houses		66
Lower grade clerks (below Rs. 60) per mensem—		
Ten blocks (6 houses in each)	60	
Seven blocks (4 houses in each)	28	
	—	88
Fitter mates, 6 blocks (15 houses in each)		90
Peons		180
Higher grade mechanics—Six blocks (6 houses in each)		36
Lower grade mechanics—Eleven blocks (6 houses in each)	66	
,, One block (3 houses in each)	3	
,, One block (5 houses in each)	5	
	—	74
Scavengers, 2 blocks (20 houses in each)		40
Coolie lines, 50 blocks (20 houses in each)		1,000
Sub-Inspector of Police		1
Blocks (quarters) for 23 constables and 3 head constables.		
Foreman's quarters		4
Indian Erector's quarters		2
European Erector's quarters		4
Maistris' quarters		40

Hospital Colony.	No.
One ward, 20 beds for males	1
One ward, 16 beds for females	1
Quarters for two European nurses (European ward)	2
Assistant Surgeon's quarters (Subdivisional Officer's type)	1
Coolie type for watchman and tottis	4
Sub-Assistant Surgeon's quarters	2
Compounders' quarters (maistri's type)	4
Female attendants	3
Male attendants	6
Infectious diseases wards, etc....	1

Offices and Public Institutions.	No.
One Post and Telegraph Office (combined).	
Two blocks of offices (Public Works Department and Audit) *	...
Tahsildar's office	1
Treasury and Police Station	1
Health Officer's laboratory and office.	
One European rest-house.	
One Indian rest-house.	
One recreation club.	
Salem Camp.	
(Permanent Buildings for the use of the Public Works Department.)	
Subdivisional Officer's quarters	1
Rest-house	1
Mechanic's quarters—3 blocks (6 houses in each)	18
Dispensary	1
(Temporary Buildings.)	
One block of four houses for supervisors.	
Four blocks of 6 houses each for maistris.	
Forty blocks of 20 houses in each for coolies.	
Two blocks of 20 huts in each for scavengers.	
Police outpost.	
One block of 4 houses for 1 head constable and 3 constables.	
One block of 6 houses for clerks.	
One block of 8 peons.	
(Corrugated iron roofed Sheds.)	
Drill sharpening sheds 1 at E.B. and 1 at L.B.	2
Engine house at R.B.	1
(50 × 40) cement store shed	3
Old cement shed in S.F. No. 104	1
Field office	...
Surki shed	1
Power house.	
Loco repair shop.	
Workshop.	
Machinery store shed.	
General store shed.	
Cement store shed near black tower.	
Cement store shed at Ellis Saddle near the Railway station.	
Shed for cement sack cleaning machine at Ellis Saddle.	
(Tiled and terraced.)	
Test house and laboratory	1
Waterworks store sheds—2 at L.B. and 1 at R.B.	3
Magazines—2 at R.B. and 1 at L.B.	3

* The southern block is provided with an upper story and the northern block consists of ground floor only.

APPENDIX B.—Extract from the Weather Reports of the Rainfall and Evaporation Station at Mettur.

Month.	Maximum temperature for month.	Minimum temperature for month.	Average of maximum daily temperature.	Average of minimum daily temperature.	Percentage of relative humidity (average).	Number of rainy days.	Total rainfall during month.	Total evaporation during month.
1928								
February ...	100·0	67·2	97·6	67·2	...	4	2·57	...
March ...	105·1	64·0	101·9	72·0	...	4	2·50	...
April ...	108·0	66·0	101·6	72·2	...	9	2·00	...
May ...	108·1	68·6	104·6	76·5	...	9	2·81	...
June ...	105·8	71·4	99·2	74·7	...	7	1·53	8·72
July ...	101·0	68·0	95·8	72·8	...	8	2·42	8·19
August ...	98·3	69·0	94·4	71·3	...	13	3·05	7·54
September ...	101·5	70·0	98·2	72·4	...	3	1·71	9·18
October ...	101·5	66·0	92·3	70·4	...	22	10·49 *	5·58
November ...	95·0	65·0	90·2	69·8	...	6	2·64	6·90
December ...	93·1	64.0	87·9	69·5	...	6	1·44	6·41
							33·16	
1929								
January ...	96·0	60·0	92·0	68·3	...	4	0·44	7·79
February ...	101·5	69·5	96·7	72·5	82·2	2	0·14	9·20
March ...	105·3	67·0	101·7	75·3	76·3	...	...	12·99
April ...	105·0	73·0	99·7	78·2	83·4	12	15·27 †	10·59
May ...	106·5	71·0	101·8	79·4	78·9	4	4·57	11·63
June ...	100·3	74·0	94·6	76·4	82·7	9	2·46	8·02
July ...	99·8	73·0	95·5	75·8	83·3	8	2·51	9·13
August ...	99·2	74·0	95·4	75·7	83·6	9	2·01	9·43
September ...	103·2	69·0	95·9	75·6	83·2	13	15·39 ‡	8·40
October ...	98·0	72·2	92·4	75·1	85·2	12	5.26	7·68
November ...	94·0	67·2	89·3	72·0	84·0	9	3·19	6·22
December ...	92·5	61·8	89·1	68·8	86·2	7	2·79	...
							54·03	
1930								
January ...	96·0	61·0	91·4	67·1	85·1	2	1·61	7·76
February ...	97·0	59·0	92·5	68·4	85·9	6	7·60§	7·67
March ...	102·5	65·5	98·8	71·9	80·3	2	1·46	11·18
April ...	105·8	71·0	101·5	77·9	79·5	3	0·72	12·60
May ...	104·0	70·0	97·7	76·2	79·9	10	5·99 ‖	10.57
June ...	99·8	73·0	94·8	75·6	80.0	8	4·48	9·342
July ...	102·9	72·2	96·3	75·5	78·6	4	3·48 ¶	11·132
August ...	100·5	73·0	95·6	75·4	79·7	7	1·47	10·417
September ...	99·8	70·5	96·5	74·9	78·4	9	4·05 **	9·689
October ...	98·0	71·0	89·4	73·5	87·8	22	8·69	5·178
November ...	94·0	65·8	88·8	71·5	83·6	12	5·56 ††	6·328
December ...	92·8	60·5	88·9	68·7	87·0	3	0·53	7·210
							45·64	
1931								
January ...	93·5	63·0	90·1	67·7	80·0	Nil.	Nil.	8·388
February ...	98·8	64·0	95·6	69·0	79·3	Nil.	Nil.	10·369
March ...	105·8	70·5	99·9	75·4	74·0	Nil.	Nil.	14·256
April ...	106.0	74·0	102·3	80·3	76·2	5	0·75	13·649
May ...	109·8	71·0	103·7	79·7	73·1	7	2·16	14·535
June ...	105·8	75·0	99·0	77·0	74·5	5	1·22	11·180
July ...	98·8	73·0	94·5	75·3	82·6	11	3·43	9·030
August ...	98·2	73·0	95·0	75·5	82·4	9	1·68	9·873
September ...	101·3	72·0	94·2	74·2	81·3	11	5·02	8·927
October ...	98·0	70·0	94·8	73·9	80·7	6	3·02	9·297
November ...	92·5	66·0	88·7	70·8	84·3	12	5·57 ‡‡	6·656
December ...	90·8	60·0	85·7	68·7	85·9	11	3·23	5·510
							26·08	
1932								
January ...	94·2	57·0	88·4	62·6	80·1	Nil.	Nil.	8·427
February ...	96·0	59·0	93·4	69·0	79·3	5	3·03	9·295
March ...	100·8	65·5	96·9	72·7	73·8	Nil.	Nil.	12·528
April ...	106·2	69·5	100·6	76·7	79·0	7	3·13	12·048

* Rainfall on 3rd, 3·59″.
† Rainfall on 23rd, 7·63″.
‡ Rainfall on 19th, 4·2″ ; on 25th, 3·27″.
§ Rainfall on 11th, 3·50″.
‖ Rainfall on 7th, 2·94″.
¶ Rainfall on 25th, 2·05″.
** Rainfall on 30th, 2·85″.
†† Rainfall on 5th, 2·76″.
‡‡ Rainfall on 4th, 2·88″.

APPENDIX C.

Chemical Analysis of Samples of Water from Mettur by the King Institute, Guindy, Madras.

Serial number	Date of collection	Source.	Physical appearance.		Quantitative in parts per 100,000.									Qualitative.				Remarks.
			Colour and transparency.	Smell.	Total solids.	Temporary hardness.	Permanent hardness.	Total hardness.	Chlorine.	Ammoniacal nitrogen.	Albuminoid nitrogen.	Oxygen absorbed (Tidya).	Nitric nitrogen.	Nitrates.	Sulphates.	Phosphates.	Iron, poisonous metals.	
1	31st May 1929.	(*a*) Tap in peons lines.	Colourless and clear.	None.	14·0	6·0	3·0	9·0	1·06	Trace.	0·002	0·025	0·025	Nil.	Present.	Nil.	Nil.	
		(*b*) River Cauvery.	White and opaque.	None.	8·0	0·5	2·0	2·5	0·3	0·003	0·006	0·093	Nil.	Nil.	Do.	Nil.	Nil.	River in floods.
2	31st July 1929.	(*a*) Tap in Clerks' quarters, Mettur camp.	Colourless and clear.	None.	6·0	1·0	2·0	3·0	0·3	0·002	0·002	0·013	Nil.	Nil.	Do.	Nil.	Nil.	
		(*b*) River Cauvery.	Yellowish and opaque.	None.	26·0	9·5	1·5	11·0	1·1	0·004	0·010	0·138	Trace.	Nil.	Do.	Nil.	Nil.	River in low water flow.
3	26th February 1930.	Tap near Post Office, Mettur camp.	Colourless and clear.	None.	18·0	9·0	2·0	11·0	1·1	Trace.	0·005	0·050	Trace.	Nil.	Do.	Nil.	Nil.	
4	13th August 1930.	(*a*) Tap near Clerks' quarters, Mettur camp.	Colourless and clear.	None.	5·0	0·0	3·0	3·0	0·7	Trace.	0·002	0·029	Nil.	Nil.	Do.	Nil.	Nil.	
		(*b*) River Cauvery.	White and opaque.	None.	10·0	1·0	3·0	4·0	0·7	0·002	0·010	0·114	Nil.	Nil.	Do.	Nil.	Nil.	
5	3rd March 1931.	(*a*) Tap near Clerks' quarters, Mettur camp.	Colourless and clear.	None.	...	...	...	...	...	Trace.	0·007	0·053	...	Nil.	...	...	...	

APPENDIX C—*cont.*

Chemical Analysis of Samples of Water from Mettur by the King Institute, Guindy, Madras—*cont.*

Serial number.	Date of collection.	Source.	Physical appearance.		Quantitative in parts per 100,000.									Qualitative.				Remarks.
			Colour and transparency.	Smell.	Total solids.	Temporary hardness.	Permanent hardness.	Total hardness.	Chlorine.	Ammoniacal nitrogen.	Albuminoidnitrogen.	Oxygen absorbed (Tidya).	Nitric nitrogen.	Nitrates.	Sulphates.	Phosphates.	Iron, poisonous metals.	
	3rd March 1931—*cont.*	(*b*) River Cauvery.	Yellowish and hazy.	None.	16·0	7·0	2·0	9·0	1·1	0·002	0·010	0·080	Nil.	Nil.	Present.	Nil.	Nil.	
6	24th August 1931.	(*a*) Tap near Clerks' quarters, Mettur camp.	Colourless and clear.	None.	...	...	...	...	...	Trace.	0·003	0·013	...	Nil.	...	...	...	
		(*b*) River Cauvery.	Whitish and opaque.	None.	12·0	1·0	1·5	2·5	0·7	0·002	0·007	0·093	Nil.	Nil.	Present.	Nil.	Nil.	The water-supply to Mettur continues to be of excellent quality.
7	27th March 1932.	(*a*) Tap in Mettur camp.	Colourless and clear.	None.	...	...	...	...	...	Trace.	0·002	0·053	...	Nil.	...	...	...	The samples of chlorinated water from the town distribution show further improvement and maintain the usual high level of purity.
		(*b*) River Cauvery.	Whitish and opaque.	None.	20·0	8·0	4·0	12·0	1·1	0·002	0·008	0·080	Nil.	Nil.	Present.	Nil.	Nil	

ARCHIVES LIBRARY 15726